

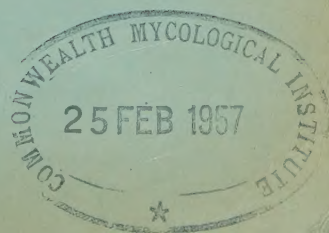


FEDERATION OF MALAYA

ANNUAL REPORT
OF THE
DEPARTMENT OF AGRICULTURE
FOR THE YEAR
1955

By
R. G. HEATH,
*Director of Agriculture,
Federation of Malaya*

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Reaping padi by sickle in North Kedah. This is the traditional but somewhat slow method.



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KUALA LUMPUR

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ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE, FEDERATION OF MALAYA, FOR THE YEAR 1955

SECTION I

POLICY AND PROGRESS

A.—POLICY

The agricultural policy of the elected Government, as laid down in broad terms in the Alliance Platform for the Federal Elections, is as follows:

1. Eventually to achieve self-sufficiency in essential food-stuffs.
2. (a) Increasing quantitatively and qualitatively existing agricultural produce and diversifying crops.
(b) Improving marketing systems.
(c) Giving financial assistance to agriculturists through the Land Bank and other agencies.
(d) Ensuring security to cultivators.
(e) Providing agricultural education on as extensive a scale as possible.

B.—ORGANISATION OF THE DEPARTMENT

2. This has remained as described in the Reports for 1953 and 1954.

C.—FINANCE

3. The Estimates in respect of Federal expenditure were approximately the same as those for 1954; the reduction in annually recurrent expenditure imposed in that year was roughly of the order of one-third in extent. This has meant that research and investigation work has continued to operate at reduced *tempo*, despite valuable assistance in the shape of Colonial Development and Welfare funds.

4. By contrast, the Estimates of most of the State and Settlement Departments of Agriculture showed further increases of funds for the development of programmes of extension work.

D.—PROGRESS IN 1955

5. The achievements of a Department of Agriculture are normally appraised by the general public, and rightly so, on the results of its extension programmes. The benefits accruing to the cultivator as the result of such work are the criteria of its importance. Nevertheless, it should not be overlooked that the basic soundness of any extension programme can only be determined by taking into account the results of planned and well-executed programmes of research and investigation. Without such

results as a guide, extension programmes may well be ill-conceived and doomed to failure with consequent loss of faith in the Department on the part of the cultivator. It is thus necessary to appreciate the value of research and investigation work in relation to extension programmes and to avoid the attitude of regarding such work as an investment of little value. It further needs to be appreciated that for research and investigation works to be efficiently planned and carried out they should not be exposed to the vagaries of annual budgets. Most of such work is on a long term basis and requires the assurance, therefore, of financial support over a reasonable period if efforts are not to be dissipated and results jeopardised.

6. Some of the main lines of work on which the Department has been engaged during 1955 may be summarised as follows:

7. *Rubber*.—The Department is responsible for the supply of approved planting material to all smallholders, both for replanting, under the auspices of the Rubber Replanting Board, and new planting. Nurseries are maintained either Departmentally or on contract.

8. The Department, in conjunction with the Smallholders' Advisory Service of the Rubber Research Institute, is also responsible for assisting new planters with the problems of opening up and developing their lands. This work increased in intensity during 1955 with the lessening of restrictions on new planting by smallholders.

9. *Padi*.—The first large scale distributions of selected seed derived from the post-war programme of selection and breeding took place during the year and comprised Nachin 5057 in the coastal areas of Malacca and the three best Serendah Kuning selections in parts of Negri Sembilan.

10. Fertiliser subsidy schemes were in operation in Kelantan, Trengganu and Malacca. The Department is in the position of being able to make specific recommendations for fertiliser application in the majority of the main padi growing areas but the low price for the crop militated against its use, more particularly in the important areas of the north-west.

11. The economic survey of padi areas which commenced in 1954 in the Krian District of Perak was extended in 1955 to cover the States of Kedah, Perlis and Kelantan together with Province Wellesley.

12. Tests were begun during the year, on a unit holding basis, of the practicability of utilising mechanical methods, either wholly or in part, in the cultivation of padi by smallholders. These tests are the logical outcome of the work carried out in previous years on the mechanisation of individual operations in connection with the cultivation of the crop.

13. *Coconut*.—Planning was undertaken during the year and a start made on the first of a series of economic surveys of this important smallholders' crop; the surveys are mainly designed to indicate to what extent replanting in certain areas is necessary.

14. *Oil Palm*.—Further progress was made in discussions with the industry relative to increased co-operation between the Department and estates in the carrying out of selection and breeding work on the crop.

15. Preliminary steps were taken to enquire into the possibilities of developing the oil palm as a smallholders' crop in Malaya.

16. *Pineapple*.—For the first time, it was possible to provide the largely full-time services of two senior officers, i.e., an Agronomist and the Canning Officer, for research and investigation on this crop and, as a result, considerably more progress was achieved as compared with previous years.

17. *Fruit*.—The output of budded fruit trees for distribution to smallholders showed a further marked increase. Improvement in nursery techniques has largely contributed to increased output.

18. *Cacao*.—Further considerable strides were made in determining the agronomic requirements of this new crop to Malaya.

19. Planning of the first pilot schemes for smallholders was in progress during the latter part of the year and it is hoped to make a start with these during the first half of 1956.

20. *New Village Agriculture*.—As mentioned in the 1954 Report, the Department has played a considerable part in the stabilisation of the agriculture of the new villages with the result that the acreage of food crops other than padi is now well above the pre-Emergency level. The selection of suitable areas of land, the provision of assistance in clearing same, the supply of planting material and breeding stock; in all these ways the Department has contributed to development under this head.

21. *Soil Surveys*.—The volume of soil survey work has further considerably increased both for specific purposes, e.g., soils suitable for cacao cultivation, potential padi areas, etc., and in connection with the general soil survey of the country.

22. It is emphasised that the above represents a summary only of some of the main lines of work carried out by the Department during the year. The work of the Department is described in detail from Section IV of the Report onwards.

E.—GENERAL

23. In concluding this section of the report, mention must once again be made of the excellent work of the staff, of all ranks, in circumstances not always easy and at times difficult.

SECTION II

AGRICULTURE IN THE FEDERATION OF MALAYA

A.—WEATHER

24. The year was marked by the exceptionally dry weather that prevailed over the whole of the country during the first half of the year and which in the North extended well into the third quarter. This exceptional weather adversely affected the off-season

wet padi crop in Province Wellesley, the off-season dry crops in the coastal padi area of Selangor, the dry padi and short-term padis in Kelantan and Trengganu and finally the early cultural operations of the main padi crop in the northern part of the country.

25. Minor flooding occurred in the last quarter of the year in Malacca, Trengganu and Pahang.

26. The north-east monsoon, which affects the east coast, was very late in arriving.

B.—CROP REPORTS

(i) RUBBER

27. Comparative acreages under rubber in the Federation are as follows:

Calendar Year	Estates (Acres)	Smallholdings (Acres)	Total (Acres)
1951 ...	1,964,000 ...	1,571,000 ...	3,535,000
1952 ...	1,997,000 ...	1,616,000 ...	3,613,000
1953 ...	2,030,000 ...	1,698,000 ...	3,728,000
1954 ...	2,018,000 ...	1,500,000*	3,500,000*
1955 ...	2,015,000 ...	1,500,000*	3,500,000*

28. Production figures for the Federation are given in the following table:

Calendar Year	Estates (Tons)	Smallholdings (Tons)	Total (Tons)
1951 ...	328,000 ...	276,000 ...	604,000
1952 ...	341,000 ...	242,000 ...	583,000
1953 ...	341,000 ...	232,000 ...	573,000
1954 ...	345,000 ...	240,000 ...	585,000
1955 ...	352,000 ...	285,000 ...	637,000

29. The Pan-Malayan imports and exports of rubber during the same periods were:

Calendar Year	Gross Exports (Tons)	Gross Imports (Tons)	Net Exports (Tons)
1951 ...	1,155,000 ...	547,000 ...	608,000
1952 ...	910,000 ...	339,000 ...	571,000
1953 ...	847,000 ...	278,000 ...	569,000
1954 ...	915,000 ...	344,000 ...	571,000
1955 ...	994,000 ...	362,000 ...	632,000

30. Rubber prices throughout the year have been generally good and averaged 95.40 cents per lb. during the first quarter, 95.33 cents per lb. and 139.31 cents per lb. during the second and third quarters and 125.09 cents per lb. during the fourth quarter.

31. Since the estate industry demands the careful and efficient management of a long-term asset, production would not be expected to react sharply to price variations; nor did it. The smallness of the increasing estate production recorded in

* Estimates only.

1955 (7,000 tons) was not entirely due to that factor, however, for output is also governed by the extensive replanting programme undertaken by estates since the war, and a period of static or small increase in production must be accepted until the replanted areas come into full bearing. Smallholding production in 1955 topped that of 1954 by some 45,000 tons, the increase undoubtedly arising from the stimulus of improved prices during the year.

32. Rubber in Malaya is generally marketed in the form of Ribbed Smoked Sheet, Crepe and Preserved Latex. Small quantities of specialised types such as Rubber Powder and Cyclised Rubber were also produced. One interesting feature of the market trend shown by an analysis of exports for the last few years is that Preserved Latex accounted for approximately 17 per cent. of total exports from the Federation in 1955.

33. The marketing of technically classified rubber (T.C.R.) continued to receive increased support and the system was generally being extended to embrace smallholding produce, the bulk of which is still, unfortunately, of sub-standard quality. Latex marketing schemes, introduced with the dual purpose of improving the quality of the rubber produced by smallholders and of increasing the value to the smallholder of his crop, have not in practice fulfilled their early promise and have, with few exceptions, made little headway in the last year or two.

34. In the report of the International Bank Mission, the views of the Mission of Enquiry into the Rubber Industry of Malaya (the Mudie Report) on the importance and urgency of enlarging the area planted to high-yielding rubber received full support, likewise the recommendation that the replanting scheme for smallholders be continued and extended and that a Government-sponsored programme of estate replanting be instituted.

35. In the White Paper on Taxation and Replanting in the Rubber Industry, the Government proposes to assist the rubber planting industry in its replanting and new planting programmes. The cost to the Government would be some \$280 million, \$112 million of which is to go to the smallholders' section of the industry. A working party has been set up to consider suitable schemes for assisting the smallholder. At the end of the year, consideration of such schemes was still in progress.

36. Smallholding interests are the concern of the Administrators of Fund "B" of the Rubber Replanting Scheme, under whose direction the Smallholders' Replanting Organisation functions. The aim is to replant a total of 500,000 acres of smallholding rubber in six years from the date of the Scheme's inception, i.e., 1952. Of necessity, having regard to the need for staff recruitment and training as well as for publicity in the early stages, the annual target for replanting was graded, commencing with 40,000 acres in the first year and ending with 90,000 acres in the final year. The whole undertaking is a most formidable one and there are few, if any, schemes elsewhere in tropical agriculture of equal magnitude and importance.

37. The replanting target of 60,000 acres for 1955 was not reached. Of 12,216 applicants who wished to replant rubber on 53,292 acres, only 10,416, totalling 43,955 acres, fulfilled the stipulated conditions and received the necessary approval. By the end of December, 8,116 of the approved applicants, with a total of 25,932 acres, had received the first cash grant which is payable when felling, clearing, lining and holing are completed and authority given to commence planting. This figure is an improvement on the 1954 figures of 7,398 approved applicants and 21,504 acres.

38. When conditions are suitable, encouragement is given to replant with crops other than rubber, the same scale of grant as in the case of rubber being paid. This policy resulted in 1955 in 1,937 smallholders (5,717 acres) applying to plant with other crops. Out of these, 1,721 applicants with 4,922 acres were accepted, as compared with 1,520 applicants (4,227 acres) in 1954.

39. From the date of commencement of the Scheme, 70,891 acres have been replanted with high yielding rubber and 7,674 acres with approved alternative crops. The latter comprised fruit 1,876 acres, coconuts 2,116 acres, coffee 1,663 acres, padi 1,011 acres, pineapples 852 acres and sago 156 acres. Up till the end of 1955 the approximate total financial outlay under Schemes 1 and 2 of Fund "B" amounted to \$20,754,024.

40. A high standard of maintenance in replanted holdings is exacted and cash grants may be withheld if maintenance is found to be sub-standard. In regard to lalang (*Imperata cylindrica*) in particular, full and complete eradication is demanded on the grounds that once it becomes firmly established, not only will the replanted rubber be several years late in coming into bearing but yields may be permanently impaired and the advantage accruing from the use of high yielding material very greatly reduced.

41. Progress of the Schemes can be judged by the number of deferments of second and higher payments. Out of a total of 17,142 first grants paid, there have been, so far, 6,364 deferments (37 per cent.). Of these, Malaysians easily top the list with 4,794 deferments (75 per cent. of total deferments), the Chinese are second with 1,424 deferments (22 per cent.) and there have been 22 deferments (3 per cent.) for smallholders of other races.

42. To the smallholder, lacking mechanical aids, the task of replanting calls for hard and sustained physical labour and no opportunity is neglected, therefore, of discovering ways and means to lighten his burden. To give an instance, the hormone 2:4:5-T, when tested as a tree killer, has shown to be of distinct promise and has been used fairly extensively.

43. In 1954, the total grant payable to smallholders was raised from \$400 to \$500 per acre, but even this additional incentive was insufficient to offset the effect of the high price of rubber which, of course, discourages replanting.

44. New planting of rubber continued, principally in Kedah, Kelantan, Trengganu, Perak and Pahang.



Replanting. A bad choice of crop. The peat soil has been replanted with rubber: coffee would have been a better choice.



45. In Kedah, Perlis and Johore there has been considerable illegal planting of smallholdings in recent years, the total area being estimated to amount to approximately 250,000 acres. Unfortunately the bulk of this planting has been with ordinary unselected seedlings.

46. Practically all States report numerous applications for new planting as the result of good prices for rubber and the easing of the Emergency. While there are bound to be delays before actual planting takes place, there is little doubt that the next few years will see a considerable increase in the acreage under rubber. In Johore, Kedah, Kelantan and Pahang, where most of the new planting occurs, active steps are being taken to organise new planting and to ensure that only high yielding seedlings are planted.

47. The current prices of 25 cents per yard and 15 cents per seedling charged to the smallholder for budwood and clonal seedlings are equated to commercial costs, and on an acreage basis the cost is approximately \$30 for either clonal seedlings or buddings, including budgrafting.

(ii) RICE

48. The 1954-55 season again saw increased interest in padi planting with a nett gain in the planted acreage of 45,100 acres over the previous season. Unfortunately, however, adverse weather conditions and the effect of pests and diseases during the season were such as to offset much of the anticipated gain in production from the increased acreage planted. Despite, therefore, the growing use of high yielding seed and fertiliser and the considerable improvements effected in drainage and irrigation, Malaya's unpredictable weather still remains the vital deciding factor in crop yields.

49. Estimates of the acreage planted in the 1955-56 season show a decrease of 3,000 acres due mainly to lack of interest in the non-commercial padi areas on account of high rubber prices. Yields also will be lower, as the main padi areas were adversely affected by drought. The following table gives comparative figures for acreage under wet and dry padi together with yields since 1950:

Season	WET PADI		...	DRY PADI		...	TOTAL PADI	
	Acreage (Planted)	Yield (Tons)		Acreage (Planted)	Yield (Tons)		Acreage (Planted)	Yield (Tons)
1950-51	829,000	685,000	...	47,000	18,000	...	876,000	703,000
1951-52	790,000	526,000	...	41,000	16,000	...	831,000	542,000
1952-53	790,000	684,000	...	44,000	16,000	...	834,000	700,000
1953-54	809,000	635,000	...	37,000	13,000	...	846,000	648,000
1954-55	843,000	633,000	...	48,000	19,000	...	891,000	652,000

50. A total area of 6,361 acres was double cropped with padi during 1955. Double cropping has been practised in the Sungei Dua area of Province Wellesley since the time of the Japanese occupation of Malaya and is slowly gaining in popularity. Owing to the necessity for a complete overhaul of the main drainage and irrigation system in this area, it was

impossible to supply irrigation water to the off-season crop and this resulted in a drop in planted acreage from 9,254 acres in 1954 to 5,908 acres in 1955 and a considerably lower yield of 239 gantangs (gallons) per acre as against an average yield of 309 gantangs per acre in 1954.

51. Dry padi in this country is grown under two entirely different sets of conditions, either in the semi-wet, as in Kelantan and Trengganu (Padi Tugalan, Padi Taboran or Padi Tenggalan) or as hill padi. The acreage under the latter is usually small and varies widely from year to year according to the acreage of land being opened up for other crops. The acreage under Padi Tugalan, etc., varies; it was 31,600 in 1953-54, 38,500 in 1954-55 and is expected to reach 42,600 in 1955-56. Certain of these areas will gradually be converted to wet padi as and when irrigation becomes available.

52. When weather permits, there is no doubt that padi is being grown more and more efficiently, but the yield increases per unit area do no more than keep pace with the additional requirements of a steadily growing population. The ratio therefore of production to consumption has varied very little since the war.

53. Production, with the exception of the padi grown at Changkat Jong, Perak, and a part of Tanjong Karang, Selangor, is in the hands of the Malays, while milling and marketing are almost entirely a Chinese monopoly. The price of imported rice steadied during 1955 following the heavy fall in price during 1954. As the result of the lower prices, the Government guaranteed minimum or support price for locally grown padi was reduced from $12\frac{3}{4}$ to 9 cents per lb. but was raised to $10\frac{1}{2}$ cents again in December, 1955, following protests from the padi growers. The easing of tension in international rice affairs and the existence of substantial rice stocks surplus to world requirements are not accepted as grounds for reducing output in Malaya, and intensification of local production by opening up potential new areas and improving existing areas, the extended use of high yielding strains and fertilisers and the introduction of improved field techniques remains the policy of the Government.

54. Under Malayan conditions, padi suffers comparatively little from diseases, an unidentified complex known as *Penyakit Merah* being probably the most important. This was very much in evidence during the 1954-55 season and resulted in serious loss of crop in certain areas. Pests, on the other hand, particularly rats and stem borers, cause considerable damage to crops annually and there is scope for the extension of organised pest control measures.

55. A subsidised fertiliser scheme was in operation in Kelantan for the fourth year in succession, and a new scheme has been inaugurated which guarantees the subsidy over a period of four years. The subsidy for 1955 was 50 per cent. (\$7.50 per 100 lb. bag). This resulted in 18,379 bags being sold, as compared with 6,626 bags in 1954 and 16,113 bags in 1953. If all farmers in the State applied manure once in three years, approximately 95,500 bags would be required annually.

56. A similar scheme was started late in the year in Trengganu but only 47 tons (1,052 bags) was sold before it became too late to use fertiliser.

57. In Malacca, a scheme involving the sale of 287 tons of inorganic fertiliser, sufficient for 2,370 acres of padi land, has been inaugurated.

58. All these schemes were made possible by the grant of \$10 million from the Federal Government to assist padi planters.

59. Large quantities of bat guano are used regularly in Kedah and Perlis and small quantities of bone meal in Malacca.

60. Post-war botanical research and agronomic investigations have progressed sufficiently far to permit the extensive demonstration on farmers' land of new padi selections and improved strains as well as improved techniques of planting and the use of fertilisers.

61. The survey and soil sampling of the large acreage of potential padi land in the Trans-Perak area was completed and a large portion of the Kedah Plain has also been soil sampled to determine its fertiliser requirements.

62. The problems of rice mechanisation up to the stage of planting have largely been solved, but those relating to planting and harvesting still present difficulties.

63. Data in regard to annual Pan-Malayan retained imports of rice and costs are given in the following table:

NET IMPORTS OF RICE
(Pan-Malayan)

Year		Tons		Value in \$
1951	...	499,000	...	218,740,000
1952	...	423,000	...	198,886,000
1953	...	494,000	...	271,079,000
1954	...	268,000	...	124,812,000
1955	...	484,000	...	164,031,000

(iii) OIL PALM

64. Oil palm cultivation in Malaya is confined wholly to estates, but with organised central processing it could equally well become a smallholders' crop. At the end of 1955, of a total of 61 estates there were 54 in production, two more than a year ago.

65. Details of acreage planted and the production of oil and kernels are as follows:

Year		Planted Acreage		Palm Oil (Tons)		Palm Kernels (Tons)
1951	...	97,377	...	48,000	...	12,000
1952	...	100,182	...	45,000	...	11,000
1953	...	108,265	...	49,000	...	13,000
1954	...	109,643	...	54,000	...	14,000
1955	...	111,000	...	54,000	...	15,000

66. The London quoted average price for palm oil for 1955 was \$642.55 per ton, \$23.48 per ton higher than the 1954 price.

(iv) COCONUT

67. The coconut comes next in importance to rice and rubber as a smallholders' crop: only 19 per cent. of the estimated total acreage of 500,000 is estate planted. The acreage under smallholdings is difficult to estimate accurately but provisional figures for 1955 indicate little change, with yields much the same as in 1954. The coastal alluvial clays have proved eminently suitable for coconut growing and, where drainage and general husbandry are of a high standard, average yields of up to 1,600 lb. of copra per acre are not uncommon.

PRODUCTION (TONS) (Federation of Malaya)

Year	COPRA		COCONUT OIL	COPRA CAKE
	Estates	Smallholdings		
1951	39,000	121,000	86,000	56,000
1952	40,000	115,000	81,000	52,000
1953	40,000	112,000	79,000	50,000
1954	40,000	124,000	97,000	62,000
1955	40,000	104,000	95,000	60,000

68. At the end of 1955 there was a total of 99 estates, 97 of which were in production.

NET EXPORTS (Pan-Malayan)

Year	COPRA		COCONUT OIL	
	Ton	Value \$	Ton	Value \$
1951	11,000*	6,606,000	68,000	87,508,000
1952	28,000*	4,501,000*	65,000	53,966,000
1953	10,000*	2,085,000	61,000	58,033,000
1954	67,000*	23,446,000*	79,000	74,719,000
1955	75,000*	24,446,000*	91,000	67,554,000

69. Coconuts are planted in both pure and mixed stands, and while the production of copra for export or for local extraction of oil is the main market interest, nevertheless, there is a very considerable trade in fresh nuts for home consumption. Estate produced copra, the result of a carefully controlled process, is of high quality and generally commands a premium when sold. Smallholding copra, on the other hand, is often of poor quality owing to lack of care and attention. But, because of a prevailing seller's market, the disposal of copra—regardless of the quality—has been a comparatively easy matter and the incentive therefore to improve quality and to grade before marketing scarcely exists.

* Net imports.

70. The main coconut areas in the Federation are the west coastal area of Johore, the Bagan Datoh peninsula in Perak and the coastal area of Province Wellesley. Coconuts are also extensively grown along the east coast.

71. Extensive drainage work on the west coast of Johore continues and the prospects of the smallholders in that area are slowly improving. Elsewhere the industry appears to be static, with perhaps a slight tendency to a decline in yield due to old age of palms and a lack of any organised replanting.

72. The Rhinoceros Beetle, *Oryctes rhinoceros*, is Malaya's worst potential coconut pest whose incidence, despite widespread propaganda, appears to be increasing. This is explained by the fact that the beetle has been found to breed extensively in felled rubber, and with rubber replanting now being conducted on such an extensive scale it is difficult to exercise the required amount of control to deny this breeding ground to the beetle.

(v) PINEAPPLE

73. Pineapples are grown throughout Malaya, but only in three States are they cultivated for the purposes of the canning trade. In the post-war rehabilitation of the industry, emphasis has been laid on permanent plantations in contrast to the catch-crop system of before the war. That a crop of such economic importance as the pineapple can be successfully grown on deep peat is indeed a fortunate coincidence and current policy therefore is to restrict sole cropping to the peat areas, of which there are large reserves.

74. The area under pineapple on both estates and smallholdings is steadily increasing both for canning purposes as well as for the fresh fruit trade. Large-scale preliminary clearing of jungle, extensive drainage works and planting were in progress in Johore and to a lesser extent in Selangor and Perak.

75. The total acreages under cultivation during the past three years are as follows:

1953		1954		1955
23,930	...	27,950	...	34,850

Out of these figures the acreages devoted to pineapple being grown for the canneries are:

		1953		1954		1955
Estates	...	8,656	...	8,976	...	13,876
Smallholders	...	10,499	...	12,106	...	16,499

Johore is by far the biggest producing area.

76. The industry, through the Pineapple Joint Industrial Council, finances the annual programme of experiments which is pursued at the Pineapple Stations in Johore and Selangor by the Department of Agriculture.

77. A total of 175.3 million lb. of fruit was received by the canneries during the year as compared with 159.8 million lb. in 1954. Out of this figure, smallholders produced 57.4 million lb. and estates 102.6 million lb.

78. Johore production totalled 158.5 million lb., Selangor 11.1 million lb. and Perak 5.7 million lb.

79. Improved husbandry is playing a very important part in improving yields and of raising the standard of the industry. This is most essential if Malayan pineapples are to hold their place on world markets and to compete with the ever growing competition from other countries.

80. Two meetings were held in 1955 between representatives of the packers and growers to negotiate agreements on fresh fruit prices of various grades. It is customary to equate the negotiated prices for fresh fruit with the ruling export price per case of canned fruit. At the end of the year, prices paid per lb. to growers were: large fruit 6 cents, medium fruit $5\frac{1}{2}$, small fruit 5 and sub-standard $2\frac{1}{2}$.

81. Export of canned pineapple products from Malaya in 1955 was 1,191,339 cases (standard 48×16 oz. cans) as compared with 926,376 cases in 1954.

(vi) CACAO

82. Observation plots of Amelonado cacao established in all States and Settlements of the Federation continued to yield valuable information which, when studied in conjunction with the results from precise experimentation, has gone a long way towards improving the knowledge in regard to husbandry techniques for cacao under Malayan conditions. The prospects of cacao as a potential economic crop for Malaya are good, especially on the better types of soil in Pahang and Trengganu, and the progress so far achieved has been followed with keen interest in the country. For instance, several States, in pursuance of their land utilisation policy, have earmarked blocks of State land for future development with cacao.

83. The report of the Cacao Working Party was published during the year and recommended that, in addition to development of the industry by estates, smallholders should likewise be encouraged to grow the crop but that the development of a small-holding industry should be through a series of pilot schemes. The first pilot schemes are expected to start in 1956.

84. Commercial planting of Amelonado cacao, begun first of all in 1953 on an estate in Trengganu, was continued and at the end of 1955 441 acres had been established on that estate. Other commercial interests are also showing considerable interest in this area.

85. Shrews, rats and squirrels have all been troublesome, even on small, well-protected holdings, and it remains to be seen, once extensive planting is undertaken, whether or not pest control will prove excessively costly.

(vii) TEA

86. Both lowland and highland teas are grown commercially in Malaya and although the former may be of poorer quality its greater yield per acre, almost double that for highland

tea, more than offsets the disadvantages of a slightly lower market price. Lowland tea commands a ready sale on the London market. On well-managed highland estates, crops of 800 lb. of made tea per acre are obtained. Tea is not exclusively an estate crop but smallholders appear not to be particularly interested and yields are low in comparison with estates. Clean weeding, despite publicity with regard to erosion dangers, is still practised by some growers.

87. Tea prices in 1955 have remained at a high level, causing the crop, temporarily at least, to be one of the most profitable to grow. Two lowland estates continued to extend their planted acreage. Highland tea averaged \$1.85 per lb. on the London market and \$1.72 per lb. locally.

88. In the highlands, the anticipated increased incidence of Blister Blight (*Exobasidium vexans*) during the wet months of November and December was effectively controlled by the use of copper fungicides. This disease although recorded from the lowlands does little serious damage.

89. Production figures are as follows:

MADE-TEA				
Year		Production (lb.)		Exports of Local Tea* (lb.)
1951	...	3,684,000	...	1,679,000
1952	...	3,785,000	...	1,752,000
1953	...	4,187,000	...	2,172,000
1954	...	4,590,000	...	2,757,000
1955	...	5,306,000	...	2,864,000

(viii) FOOD CROPS, VEGETABLES AND FRUITS

90. The acreage under food crops increased from 95,600 acres at the end of 1954 to 96,900 acres at the end of 1955. The main rice substitute crops were sweet potatoes, tapioca and yams. Tapioca was also extensively grown for the production of starch. During the annual fallow it is customary in the east coast States of Kelantan and Trengganu and in Kedah, Penang, Selangor and Malacca to cultivate small selected areas of the rice fields with crops such as groundnuts, maize, beans, chilli, cucumber and lobak.

91. Conditions in new villages have now become stabilised and great changes in the acreage under food crops and vegetables are unlikely in the future, but increases can be expected while there is extensive new planting and replanting of rubber going on.

92. The considerable acreages of intensely cultivated market gardens which exist mainly for the production of leafy-type vegetables—chiefly lettuce and mustard—were maintained. In Cameron Highlands, where cabbages are widely grown as a speciality crop, there was about 1,200 acres under vegetables.

* In addition to these quantities, a small amount of Malayan tea is mixed with foreign teas and then exported.

93. Water melons were an important seasonal crop in the northern States experiencing monsoon conditions.

94. Bananas were more and more favoured as a catch-crop in new planted and replanted rubber, the planted acreage showing a slight increase over that of 1954.

95. Fruit trees in mixed stand are a feature of every kampong and the total area throughout the Federation is estimated at 93,000 acres, an increase of 2,000 acres over 1954. Much of this increase is due to the conversion of old rubber lands to fruit under the rubber replanting scheme and interest in the production of Mandarin oranges. The Department of Agriculture's selected fruit clones are popular and the distribution of large quantities of improved planting material was an important Departmental undertaking.

96. The fruit harvest was generally good and above average in most areas.

(ix) MANILA HEMP

97. On the experimental evidence so far available, the variety Tangongon would appear to be the best suited to Malayan conditions. Although satisfactory yields have been obtained on some volcanic soils and on well drained alluvial clays, no developments of any importance occurred in 1955.

(x) RAMIE

98. Cultivation is confined almost wholly to experimental planting. Trials have shown that the crop requires a high standard of cultivation and heavy manuring on most Malayan soils.

(xi) COFFEE

99. Coffee is essentially a smallholders' crop in Malaya and, on the present scale of cultivation, production is barely sufficient to meet local requirements. The average price for Liberica, the only planted variety of any importance, was between £364 and £434 per ton of dried beans, giving an estimated gross return per acre of anything from £82 to £103. The revival of interest in this crop is, therefore, understandable. Furthermore, future prospects appear good, since it is by no means certain that a slump in world prices would have a similar effect on internal prices in view of the fact that local demand, far from satisfied, is actually increasing. The planted acreage increased in 1955 to 12,600 acres.

(xii) SPICES

100. Only arecanuts and pepper are of importance as export crops. Other spices such as chillies, ginger, turmeric, sireh, nutmegs and cloves, are all cultivated on a small scale exclusively for the internal market.

(xiii) TOBACCO

101. Tobacco is an important cash crop usually grown in rotation with market garden vegetables, or as an off-season crop in padi areas. Though the leaf is coarse in quality it meets with

a ready sale for the manufacture of cut tobacco and cheroots. The acreage planted was estimated at 4,200.

(xiv) MISCELLANEOUS CROPS

102. Other crops of minor importance grown were derris, gambier, kapok, ipecacuanha, patchouli, citronella, sugar palm, nipa palm, sago, groundnuts, maize, yams and pulses.

C.—STOCK

(i) CATTLE, BUFFALOES, GOATS AND SHEEP

103. Livestock, though an important capital asset in small-holding agriculture, are raised and maintained with the minimum of trouble to the owner. Mixed farming in the generally accepted sense is not practised. In the main padi-growing States, buffaloes and cattle are primarily used as draught animals, the production of meat and milk being of secondary importance. In certain States extensive areas are set aside as communal grazing grounds, but for the most part they are infrequently used and are not well maintained. Seldom, if ever, are concentrates fed. Milk production on a small scale is conducted by Indians in the vicinity of the larger towns.

104. Sheep are found in the drier east coast areas though not in large numbers. Goats are kept in most areas.

(ii) PIGS

105. The prices of feeding stuffs remained high with the result that the average price of pork fell but little despite the substantial increase in the pig population. With the return to stable conditions in the new villages, pig production regained pre-Emergency level and the Federation once more became an exporter of pigs to Singapore. The use of Middle White boars for crossing with the local sows is now established practice in all the major pig-rearing areas.

(iii) POULTRY

106. A considerable trade continued to exist in poultry and eggs. There were large numbers of small-scale poultry rearers both in rural and urban areas whose needs in the way of breeding stock and eggs for hatching were met mainly by the commercial poultry farms. These commercial poultry farms are highly organised units which rear both local and imported breeds. The Rhode Island Red and White Leghorn remain the most popular of the imported breeds. Interest in imported breeds, except in urban areas, has waned during the year.

TABLE I

DEPARTMENT OF AGRICULTURE, 1955

Organisation and Establishment by Branches (excluding Clerical and Non-technical Minor Posts)

DIRECTOR					
DEPUTY DIRECTOR					
RESEARCH BRANCH	AGRONOMY BRANCH	FIELD BRANCH	PUBLICATIONS BRANCH	EDUCATION BRANCH	ADMINISTRATION BRANCH
1 Chief Research Officer	1 Senior Agronomist	1 Chief Field Officer	1 Publications Officer	1 Principal, College of Agriculture	1 Administrative Officer
5 Heads of Divisions: Senior Botanist Senior Chemist Senior Soils Chemist Senior Entomologist Senior Plant Pathologist		1 Personal Assistant 6 Senior Agricultural Officers 11 Agricultural Officers 1 Agricultural Economist		2 Senior Lecturers 1 Registrar and Bursar	1 Office Assistant 1 Financial Assistant
14 Other Senior Officers	13 Other Senior Officers				
5 Senior Officers (<i>Leave Reserve</i>)	4 Senior Officers other than Professional	7 Senior Officers (<i>Leave Reserve</i>)			
1 Assistant Chemist	1 Assistant Statistician				
19 Agricultural Assistant Service Scheme	15 Agricultural Assistant Service Scheme	102 Agricultural Assistant Service Scheme			
36 Junior Agricultural Assistant Service Scheme	27 Junior Agricultural Assistant Service Scheme	175 Junior Agricultural Assistant Service Scheme			
19 Miscellaneous Junior Technical Posts	8 Miscellaneous Junior Technical Posts				
100 Posts	69 Posts	304 Posts	3 Miscellaneous Junior Technical Posts 4 Posts	9 Agricultural Assistant Service Scheme 2 Miscellaneous Junior Technical Posts 15 Posts	1 Horticultural Assistant 3 Posts 2 Posts

SECTION III

THE DEPARTMENT OF AGRICULTURE ESTABLISHMENT AND STAFF

A.—ESTABLISHMENT

107. The establishment of the Department is shown at Table I. The number of posts for senior professional officers remained at 70. There were eight vacant posts at the close of the year, made up as follows:

Deputy Director of Agriculture	1
Senior Lecturer, College of Agriculture ...	1
Chief Research Officer	1
Plant Pathologist	1
Statistician	1
Senior Entomologist	1
Senior Soils Chemist	1
Chemist	1

B.—SENIOR STAFF CHANGES

(i) BRANCH HEAD POSTS

108. (a) *Head Office (Administration)*.—Mr. R. G. Heath, Deputy Director of Agriculture, was appointed to act as Director of Agriculture with effect from the 23rd December, 1954, and continued to carry out those duties until 23rd June, 1955, when he was appointed Director of Agriculture, Federation of Malaya.

109. (b) *Field Branch*.—Mr. J. R. Curry, Chief Field Officer, acted as Deputy Director of Agriculture until 11th April, 1955, when he proceeded on leave prior to retirement. Mr. J. Cook, Senior Agricultural Officer, was appointed to act as Chief Field Officer with effect from his return from long leave on the 6th January, 1955, and carried out those duties until the 12th April, 1955, when he was appointed to act as Deputy Director of Agriculture, in which post he remained until the end of the year.

110. Mr. P. G. Coleman, Agricultural Officer, was posted to Headquarters, Kuala Lumpur, on his return from leave and assumed duty as Acting Chief Field Officer with effect from the 12th April, 1955, and remained in that post until the 12th September, 1955, when he was transferred to Kelantan to act as State Agricultural Officer.

111. Mr. H. J. Simpson, P.J.K., Senior Agricultural Officer, was posted to Headquarters, Kuala Lumpur, on his return from long leave and assumed duty as Acting Chief Field Officer with effect from the 26th September, 1955, and carried out the duties of the post until the end of the year.

112. (c) *Research Branch*.—Mr. R. B. Jagoe, Chief Research Officer, proceeded on leave prior to retirement on the 11th July, 1955, and Mr. L. N. H. Larter, Senior Botanist, carried out the duties of Chief Research Officer from the 12th July, 1955, until the end of the year.

(ii) RECRUITMENT

113. The following officers were recruited during the year :

- (1) Mr. F. N. G. Conaty, B.Sc., A.R.I.C., was appointed Canning Officer, Malayan Agricultural Service, with effect from the 18th March, 1955.
- (2) Mr. C. R. Raper, B.Sc. (Agric.) D.T.A., was appointed Agricultural Officer, Malayan Agricultural Service, with effect from the 19th August, 1955.
- (3) Mr. R. J. R. Barrett, B.A. (Hons.) Cantab., Dip. Agr. Cantab., was appointed Agricultural Officer, Malayan Agricultural Service, with effect from the 19th August, 1955.
- (4) Mr. D. L. Stacey, B.S.A. (U.B.C.), was appointed Agricultural Officer, Malayan Agricultural Service, with effect from the 19th August, 1955.
- (5) Mr. G. I. M. Martin, B.Sc. (Agric.), Dip. Agri. (Cantab.), D.T.A., was appointed Agricultural Officer, Malayan Agricultural Service, with effect from the 25th November, 1955.

(iii) RESIGNATIONS

114. Mr. G. Youatt, B.Sc. (Hons.), Ph.D., Chemist, resigned from Government Service with effect from the 10th May, 1955.

115. Mr. I. Watson, B.Sc., Statistician, resigned from Government Service at the expiration of his probationary period on the 8th September, 1955.

(iv) RETIREMENTS

116. The following officers retired during the year :

- (1) Mr. O. J. Voelcker, C.B.E., M.A., A.I.C.T.A., Director of Agriculture, on the 7th July, 1955.
- (2) Mr. H. T. Pagden, M.A., F.R.E.S., Senior Entomologist, on the 23rd June, 1955.
- (3) Mr. R. B. Jagoe, B.Sc. (Hons.), Chief Research Officer, on the 20th December, 1955.
- (4) Inche Mohd. Rashid bin Ahmad, Assistant Lecturer, College of Agriculture, Malaya, on the 15th June, 1955.
- (5) Tuan Haji Abdul Wahid bin Haji Jaafar, Assistant Research Officer, Headquarters, Kuala Lumpur, on the 31st December, 1955.

(v) PROMOTIONS

117. Mr. R. G. Heath, Deputy Director of Agriculture, was promoted to the post of Director of Agriculture, Federation of Malaya, with effect from the 23rd June, 1955.

118. Mr. A. Johnston, Plant Pathologist, was promoted to the post of Senior Plant Pathologist, Federation of Malaya, with effect from the 13th July, 1955.

119. The following officers, who proceeded overseas for training to equip themselves for promotion to posts in Division I, returned to Malaya in 1955:

- (1) Mr. K. Kanapathy, B.Sc. (Hons.) (Madras), M.Sc. (Agri. Chem.) (Adelaide), was promoted to the post of Chemist with effect from the 10th June, 1955.
- (2) Mr. Lee Sin Fook, B.Sc. (Agric.), was promoted to Pupil-Agricultural (Livestock) Officer with effect from the 11th September, 1955.

(vi) TECHNICAL ASSISTANCE, COLOMBO PLAN

120. Mr. W. F. Grant, a Technical Officer under the Colombo Plan, completed his term of office and left Malaya on the 30th July, 1955, to return to Canada.

(vii) LEAVE

121. The following officers were on leave in the United Kingdom at the close of the year:

- Mr. R. Henderson, M.C., B.Sc.,
Mr. T. R. Dickinson, B.Sc. (Agric.), Dip. Agri. (Camb.),
D.T.A.,
Mr. P. Class, B.Sc. (Agric.), D.T.A.,
Mr. H. M. James, M.C., Dip. Agri. (I.C.T.A.),
Mr. J. S. Ure, B.Sc. D.T.A.,
Mr. J. R. Curry, Dip. Agri. Sci. (Dunelm), N.D.A.,
Mr. D. W. M. Haynes, B.Sc., A.M.I.B.A.E., and
Mr. H. Ritchings.

SECTION IV

WORK OF THE DEPARTMENT OF AGRICULTURE

A.—RESEARCH AND INVESTIGATION

1.—PADI (RICE)

(i) VARIETY SELECTION AND BREEDING

122. (a) *Variety Trials*.—Results of yield trials completed up to mid-1955 have been published in the Departmental Bulletin "Rice Variety Trials in Malaya, 1950-54" by L. N. H. Larter. This report deals primarily with trials of unselected varieties, either of varieties of secondary importance in the areas in which they are now grown or of promising varieties from other parts of the Federation. In areas where a number of well adapted pure line selections are available, these predominated in the trials.

123. Further provisional recommendations for maximum yield suggested by these trials may be summarised as follows:

PERLIS—

In areas where lodging is not general, Subang Intan 11 and 16, Siam 29 and Chubai 18 should be preferred for their yield.

Radin China 4 and Mayang Ebos 80 remain the best of the strong-strawed, non-lodging varieties, but Radin Benua may be expected to give higher yields in areas subject to frequent damage by floods.

KEDAH—

Short term varieties—Radin Kling and Burma D. 34-11.

Medium term varieties—the standard varieties Siam 29 and Mayang Ebos 80 have been confirmed as most reliable on both richer and lighter soils but Mayang Pasir 28 outyielded Mayang Ebos 80 by 8 per cent. on the richer coastal soils. Subang Intan selections 38 and 117 are also promising.

Nachin 5057 should give increased yields on the lighter soils and in areas where lodging is not usual.

Long term varieties—Seraup Kechil 48.

PENANG AND PROVINCE WELLESLEY—

The long term varieties recommended for the Genting area of Penang and for South Province Wellesley are the same as those for the North Krian district of Perak, viz., Seraup Kechil 48, Machang and Mayang Sabatil 8. Pebifun remains the standard variety in the double cropping areas of Central Province Wellesley. B.M. 5 and Gochisai should give similar yields and the latter may prove more tolerant to *Penyakit Merah* than Pebifun.

PERAK—

NORTH KRIAN—

Seraup Kechil 36 and 48, Machang (unselected), Machang (615), Mayang Sabatil 8 and (443).

SOUTH KRIAN—

Seri Raja generally and Siam 29 and Nachin 11 in non-lodging areas.

CENTRAL PERAK—

Seri Raja, Radin Mengkudu and Nachin 11.

SOUTH PERAK—

Seri Raja, Radin Mengkudu.

NEGRI SEMBILAN—

Short-medium varieties—Acheh Puteh and Kuatek are recommended, but the latter variety is liable to flood damage.

Medium term—Serendah Kuning 11.

TRENGGANU (*Besut*)—

Padang Trengganu 22 and Tongkat.

KELANTAN—

Bachok and light coastal soils—Siam 29 and Reyong 6.

Pasir Puteh District and medium soils—Anak Ulat (208), Jintan Puteh (34) and Siam 29.

No new recommendations are made for areas not mentioned above.

124. During 1955, four new trials involving unselected varieties were commenced as follows:

- (i) *P. 335 at Gerai Padi Test Station, Trengganu*, to test the best varieties from the former trial (P. 224) against promising varieties from observation plots at this station.
- (ii) *P. 336 at Gelugor Padi Test Station, Trengganu*. A trial of local long term varieties.
- (iii) *P. 343 at Bachok Padi Test Station, Kelantan*, to test a number of varieties introduced from Indo-China against Siam 29.
- (iv) *P. 355 at Parit Satu Padi Test Station* to assess the performance of some Kelantan semi-dry padis on the peaty soil of Selangor.

125. Observation plots of the Sarawak varieties Engkatek and Bungka Muda have been planted in all States and Settlements following their excellent performance at Jasin Padi Test Station, Malacca, in the 1954-55 season.

126. (b) *Variety Survey*.—Six collections of Malayan varieties have been maintained and additions made. The number of varieties represented at each locality is:

(a) Very short term varieties:

Kuala Lumpur (Cage)	27
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(b) Short term varieties:

Telok Chengai Padi Experiment Station, Kedah	12
Pulau Gadong P.E.S., Malacca	30
Kota Bharu P.E.S., Kelantan	16

(c) Medium term varieties:

Telok Chengai P.E.S.	200
Pulau Gadong P.E.S.	452
Kota Bharu P.E.S.	346

(d) Long term varieties:

Titi Serong P.E.S., Perak	150
Jelawat P.T.S., Kelantan	50

1,283

127. A collection of the wild rices of Malaya is being made during the current season to enumerate the species which occur and to confirm the existence of natural hybrids between the wild and cultivated species of *Oryza*. During the year a detailed study including cytological work has been carried out with *Oryza ridleyi*. This species appears to be unique in several of its characters.

128. Eighty new varieties of padi have been received, both from abroad and from Malaya, and been grown in the cage at Kuala Lumpur. Altogether, 134 samples of Malayan padi

varieties have been sent to overseas countries, including Turkey, India, Ceylon, Argentina, Sarawak, North Borneo, Fiji, U.S.A., Seychelles, Tanganyika and Iran.

129. Over 2,000 rice samples have been examined for Government Departments.

130. (c) *Variety Selection*.—Pure line selection within 14 major varieties has been continued but no new selection project has been commenced. Four new selections (Serendah Kuning 3, 11 and 23 in Negri Sembilan and Nachin 57 in Malacca) have been recommended for general distribution to farmers. (See also under *Extension Trials*). No reductions in the number of lines in any of the varieties in the early stages of selection have been made for the 1955-56 season; this is in implementation of the revised policy of recording yields over three successive years in order to reduce differential seasonal effects and therefore to avoid the inadvertent discarding of valuable material. Stocks of other varieties (Nachin, Siam, Serendah Kuning, Radin Ebos, Mayang Sabatil and Seraup) have been maintained unreduced in numbers pending final variety trials.

131. (d) *Trials of Pure Line Selections*.—(i) *Radin Ebos (Kedah)*.—In the first season of the final selection trial at Telok Chengai Padi Experiment Station, several new Radin Ebos selections significantly outyielded the controls, M.E. 80 and R.C. 4. Two of these selections, R.E. 30 and R.E. 64, have also shown promise in a preliminary trial at Seriab Padi Test Station, Perlis.

132. (ii) *Mayang Sabatil (Penang, Province Wellesley and Perak)*.—Variety trials incorporating new M.S.B. selections at the Padi Test Stations at Genting and Sungei Acheh, in Penang and Province Wellesley, and Kuala Kurau, Titi Serong and Briah, Perak, were all badly affected by *Penyakit Merah* and they will have to be continued for a fourth season before there are sufficient data for final selection.

133. (iii) *Seraup (North Perak)*.—A new trial comparing 24 new Seraup selections with S.K. 48 has been laid down at Simpang Tiga Padi Test Station and Titi Serong Padi Experiment Station this season.

134. (iv) *Serendah Kuning (Negri Sembilan)*.—The final selection trial of Serendah Kuning strains at the three Negri Sembilan stations has been continued for a fourth season in order to obtain data from three comparable years. Agronomic and cultural practices have changed, especially in the Ulu Klawang area, and varietal performance may also have been affected.

135. (v) *Serendah Kuning (Pahang)*.—Variety trials using Serendah Kuning 3, 11, 23, 29 and 31 have been successful in their first season at Dong and Pahang Tua Padi Test Stations. At the latter station, all Serendah Kunings gave significant yield increases over the control variety Seri Menjadi. At Kerdau Padi Test Station the trial was flooded and failed.

136. (vi) *Nachin (Malacca)*.—A final variety trial of new Nachin selections was completed. Eleven out of 24 selections gave a significant yield increase over the control, Nachin 11. Of these, Nachin 39 and Nachin 2 gave increases of 31 per cent.

and 27 per cent. respectively over three seasons. These two varieties will be tested in extension trials before being recommended for release to farmers. There is also some indication of differential lodging resistance among these new varieties.

137. A trial of Nachin selections has also been established at Telok Chengai Padi Experiment Station, Kedah, this season, and observation plots have been planted at Tangkak Padi Test Station, North Johore, which serves an area in which Nachin may be expected to do well.

138. (vii) *Siam (Malacca)*.—The variety trial (P. 311) of 24 Siam selections and Siam 29 has entered its second year at Jasin Padi Test Station and has been replicated at Pulau Gadong (in Malacca) and Telok Chengai (in Kedah) Padi Experiment Stations this season.

139. (e) *Extension Trials*.—Ten series of varietal extension trials were carried out in the 1954-55 season as follows:

140. (i) *Subang Intan 16 in North Kedah (Kota Star North)*.—This is a pre-war selection which has shown promise in variety trials and 53 plots were harvested, mostly from the inland district of Langgar and the surrounding area. A mean increase of 15 gantangs (84 lb.) per acre was obtained over all the plots. Indications are that this variety would give large increases in the coastal areas.

141. (ii) *Siam 29 in Trengganu*.—This trial was exploratory and six plots only were harvested, but the yield increase of 557 lb. per acre over local varieties indicates the possibilities of this variety.

142. (iii) *Mayang Sabatil 8, Machang and Seraup Kechil 48 in North Krian, Perak*.—This trial took place in four districts of North Krian, i.e., Tanjong Piandang, Parit Buntar, Bagan Tiang and Kuala Kurau. There were no significant differences in yield between varieties. Control varieties in 38 out of 52 plots were the same as one of the varieties under test, Machang predominating in 26 out of the 38 plots. Results may be summarised as follows:

	No. o Plots	Machang	S. K. 48	M. S. B. 8	Local Control
Mean Yields (gantangs per acre)					
Parit Buntar ...	12	301	289	322	297
Tanjong Piandang ...	13	562	515	533	522
Bagan Tiang ...	12	480	413	414	464
Kuala Kurau ...	15	469	457	457	498
North Krian ...	52	456	423	435	450

143. (iv) *Mayang Sabatil 8, Seri Raja and Seraup Kechil 48 in South Perak*.—Long term varieties were consistently superior to the local medium term padis, but many of the trial plots were badly affected by drought during the growth period and results therefore are inconclusive.

144. (v) *Seri Raja in North and Central Perak*.—This variety was tested in Kuala Kangsar, Dindings and Upper Perak (Tasek

and Lenggong). In all areas a highly significant increase in yield was obtained, the summarised results being as follows:

District	No. of Plots	Yield Increase (gtg. per acre)
Kuala Kangsar ...	59	80
Dindings ...	33	128
Lenggong ...	22	160
Tasek ...	30	132

At 24 plots in the north-west (South Krian area) the average increase obtained (28 gtg. per acre) was not significant but confirmed previous years' results in the same area. A large percentage of the control plots in this area were planted with the same variety.

145. (vi) *Mayang Sabatil 8, Pahit and Seri Raja in the Riverine Districts of South Perak.*—Pahit was consistently the highest yielder. Rat damage was severe in many cases and climatic conditions were generally unfavourable. Results in previous years also indicated the suitability of Pahit to these riverine areas and further trials should be undertaken.

146. (vii) *Serendah Kuning Selections in the Bentong District of Pahang.*—This trial was exploratory and plots at six locations only were harvested but in all cases there was an increase over the local variety, yields being in the descending order Serendah Kuning 23, 3, 11, local variety.

147. (viii) *Serendah Kuning 3 in the Kuala Lipis District of Pahang.*—This trial was combined with a fertiliser extension trial and results showed a significant yield increase both by the use of Serendah Kuning 3 and wherever fertiliser was applied.

148. (ix) *Serendah Kuning Selections in Negri Sembilan.*—The second year in which this extension trial, using Serendah Kuning 3, 11 and 23 at 150 locations in five districts of Negri Sembilan, was carried out confirmed previous results and specific recommendations have now been made for large-scale distribution in the 1956-57 season.

149. Serendah Kuning 11 is the most adaptable of the strains tested and will give increases in all districts of the State; but to obtain maximum yield increases Serendah Kuning 3 is more suitable for Jelevu District and Serendah Kuning 23 for Seremban and Port Dickson Districts.

The results of two years' trials are as follows:

District	Variety	Yield Increase (per cent.)		
		1953-4	1954-5	1953-5
Kuala Pilah ...	Ser. Kun. 11 ...	4.9	12.6	7.6
Rembau ...	„ 11 ...	14.5	23.7	17.2
Tampin ...	„ 11 ...	10.3	26.2	16.5
Jelevu ...	„ 3 ...	12.8	15.5	14.6
Seremban...	„ 23 ...	43.6	43.0	43.3
Port Dickson ...	„ 23 ...	—	28.7	28.7
Negri Sembilan ...		20.6	12.6	15.8

It is estimated that 15 to 18 per cent. of the padi land in the State is already planted with these newly selected strains.

150. (x) *Nachin 5057 in the Coastal Districts of Malacca.*—A specific recommendation for the extension of Nachin 5057 has been made following the results of this trial, in which that variety was compared with Nachin 11 (a pre-war selection) and Nachin Kampong at 33 sites on farmers' land in the coastal districts of Malacca. Nachin 5057 outyielded N. Kampong in 29 of the 33 areas, being significantly different in 17 of them, and outyielded Nachin 11 in 25, of which 10 were significant. Nachin 5057 was only outyielded in four cases (none significant) where it lodged abnormally. Over all 33 plots N. 5057 gave a yield increase over N. Kampong of 26.1 per cent. and over N. 11 of 9.2 per cent. Yields generally were good, N. 5057 averaging 2,916 lb. per acre, N. 11, 2,711 lb. per acre and N. Kampong, 2,400 lb. per acre.

151. The practical implication of the use of N. 5057 in the 17,400 acres of the coastal district is that an increased production of 20.6 per cent., i.e., 4,029 tons of padi (2,540 tons milled rice), is possible. Nachin 5057 will cost the farmer nothing more to grow and he may expect to make \$50 per acre by the increase obtained.

(ii) QUALITY ASSESSMENT

152. Preliminary quality determinations in rice varieties have been continued using a McGill sample rice huller.

153. A standard technique for cooking tests has been evolved and imbibition ratios, $I = \frac{\text{Vol. of cooked rice}}{\text{Vol. of uncooked rice}}$, determined for 41 new Nachin and 41 Siam selections and 15 families of *indica* × *japonica* hybrids. There were no statistically significant differences in the I value between Nachin and Siam (mean=3.4) but within varieties there were differences between selections, the ratio varying from 2.9 to 3.7. Siam selections in general appear to be of better cooking quality than Nachin, being firmer and less sticky.

154. Of 15 hybrid families tested, two showed *japonica* type rice, one was intermediate and the rest were of *indica* type.

155. A standard technique, very similar to that in use in the U.S.A., has been perfected for milling tests and 187 samples representing varying grain types have been examined. In the varieties Nachin, Serendah Kuning and Siam, it has been possible to demonstrate significant differences of milling quality between strains within each variety but no definite conclusions can be drawn until the experiment has been repeated over a number of years with samples from different localities. In all varieties tested the percentage of chaff and bran was fairly constant, amounting to 27 to 28 per cent.

(iii) HYBRIDISATION

156. The two groups of hybrids, *indica* × *japonica* and local *indicas*, occupy a large proportion of the available land at the Padi Experiment Stations at Telok Chengai, Kedah, and Pulau

Gadong, Malacca. Both sets have shown increasing vigour during the last season. With the limited land and staff available the minimum number of records only are being taken and in many progenies selection has to be deferred, the whole plot being reaped and resown with a random sample of the bulked seed.

157. (a) *Indica* × *Japonica* Hybrids.—(i) F_2 Generation.—Seven further samples representing five new cross combinations and two crosses previously supplied in small quantity were received from Cuttack, India, in April. They are:

	New Crosses	Previous Crosses (Supplementary seed)
Fukoku	× Serendah Kuning	Norin 20 × Serendah Kuning
„	× Haji Haroun	(Gimbozu × S. Kun.) × S. Kun.
Zuihuo	× Haji Haroun	
„	× Serendah Kuning	
Gimbozu	× Siam 29	

These samples are being grown only at Pulau Gadong in the protective wire cage.

158. (ii) F_3 Generation.—This generation was represented by nine crosses and seven backcrosses, and of these, two crosses only (Norin 6 × M. E. 80 and Gimbozu × Nachin 57) were represented at Telok Chengai, the remainder being grown in the cage at Pulau Gadong. Growth at the Kedah station was good but the percentage set of seed was lower than usual, probably due to unfavourable weather during the flowering period. Maturation periods varied from 30 to 110 days (sowing to maturity). Fifteen selections were made and are being grown in pedigree lines this season. F_3 progeny plots of both crosses have been planted.

At Pulau Gadong, the young plants were damaged by floods in December, 1954, and January, 1955; a few were lost and most appeared to suffer more than local varieties. Stem borer damage was also greater, probably due to the later planting necessitated by the shorter maturation period. The backcross plants were more vigorous and maturation periods were longer. Altogether, 239 F_3 plants were selected for pedigree lines in the 1955-56 season and have since been planted.

159. (iii) F_4 Generation.—Distribution of this material for 1955-56 is as follows:

	Pulau Gadong		Telok Chengai
Progeny plots ...	34 (34)	...	27 (27)
Pedigree lines ...	413 (1,629)	...	978 (1,201)

The previous year's figures are in brackets.

160. At Telok Chengai, the ripening period of the 1954-55 crop was more extended than usual probably due to the inclement weather of the previous November and December. Approximately 8 per cent. of the pedigree lines did not set seed due to drought. The mean maturation period of this generation has been increased to 95 days by discard of all precocious lines. Crosses involving Taichu 65 and Pebifun were again the most vigorous and highest yielding.

161. Growth of the 1955-56 crop has so far been good and certain of the pedigree lines appear to be approaching homozygosity. There have also appeared in the pedigree lines this season selections that are obviously extremely susceptible to *Penyakit Merah*. Whole lines stand out with the typical leaf symptoms of this complaint but appear to grow out of it after some weeks.

162. In some progeny plots, completely pigmented plants (violet) have appeared in several cases in families in which both parents have no coloration.

163. At Pulau Gadong, growth was more uneven and individual plant yields much smaller. The crop was set back by the floods in November and December, 1954, but progress was nevertheless made.

164. The nurseries of the 1955-56 crop were submerged by floods in November for four days but no damage has been apparent since and the crop was, at the end of 1955, growing healthily in the field.

165. (iv) *F₅ Generation*.—At both stations the pedigree lines and progeny plots of the four families in this generation have continued to give much improved material. Distribution is:

		Pulau Gadong		Telok Chengai
Progeny plots ...	...	4 (4)	...	4 (4)
Pedigree lines ...	...	313 (441)	...	254 (337)

166. The 1954-55 pedigree lines were planted in two replicates at Telok Chengai but selection was carried out in one only due to damage by drought to the second. The mean yield of these four families was of the order of 1,400 lb. per acre, this yield having trebled since the 1952-53 season, thus indicating the progress that has been accomplished. Maturation periods at both stations have increased and are now in the 90 to 140 day category.

167. (v) *Off-Season Growth*.—During the 1955 off-season, observation plots of 15 families (four *F₅* families at Bukit Merah, Province Wellesley, and four *F₅* families plus eleven *F₄* families at Pulau Gadong) were grown to assess the percentage of period-fixed plants occurring. At both places 90 to 100 per cent. of the plants were successfully grown out of season. Pure line selection of period-fixed strains from these progenies should therefore be undertaken when staff are available.

168. (b) *Hybrids of Local Varieties*.—As with the *indica* × *japonica* material, as many progenies as possible are being selected at both Telok Chengai and Pulau Gadong Padi Experiment Stations in progeny plots and ear rows. This hybrid material is still actively segregating but there is good expectation of selecting vigorous, heavy yielding strains. Owing to insufficient junior staff at Telok Chengai, selection could only be carried out in one-third of the *F₃* and *F₄* progeny plots of these families last season but normal selection was possible at Pulau Gadong, where supplementary temporary staff was available. Individual

plant yields from the majority of families were of the same order as in established local varieties but, especially at Telok Chengai, plant yields in excess of 100 gm. were frequent. A summary of the local hybrids planted in the 1955-56 season is given below:

		TELOK CHENGAI		PULAU GADONG		TOTAL	
		Pedigree Lines	Progeny Plots	Pedigree Lines	Progeny Plots	P.L.	P.P.
F ₃	...	1,042	15	—	16	1,042	31
F ₄	...	1,752	28	1,390	28	3,142	56
F ₅	...	530	9	667	9	1,197	18
Total	...	3,324	52	2,057	53	5,381	105

(iv) INDUCED MUTATION

169. (a) *X-Rays*.—Following recent reports of the production of strong-strawed mutants in cereals by use of X-rays, this technique has been utilised in preliminary investigations using the variety Siam 29.

170. The dose recommended in the U.S.A. (25 R units) proved too strong and there was 100 per cent. mortality of the germinating seedlings. A second attempt, using 5, 10, 15 and 20 R units on germinating seed, has been successful in defining the amount of irradiation required. A dose greater than 5 R units leads to death of the material. Irradiated seedlings are being grown in observation plots at Pulau Gadong, Malacca, this season.

171. (b) *Colchicine*.—In order to develop a technique suitable for the production of polyploid padi varieties, investigations with colchicine solutions on germinating seedlings have been initiated. By soaking seedlings in a 0.2 per cent. solution for three hours at 27°C. it is provisionally estimated that approximately 25 per cent. of the material is affected. Soaking for less than three hours seems inadequate.

172. It has not yet been possible to confirm by chromosome counts the existence of polyploids among the treated plants but visual symptoms suggest that chromosome numbers have been altered. Anther squashes showed that, at metaphase I and II, the plates were longer than usual and individual cells were larger than in untreated plants.

(v) NATURAL CROSS POLLINATION

173. The first part of this experiment was completed successfully and with the exception of one variety (Merah Isi) all plants were in flower simultaneously. Random samples of seed of those plants in which natural cross-pollination was expected were planted out as observation plots in order to determine the actual cross-pollination which took place.

(vi) SEEDLING AGE

174. Results of two trials carried out in Negri Sembilan to test the effect of reduced seedling age on yield have confirmed

that the optimum seedling age at transplanting is around 35 days for medium term varieties. They also show that a reduction in seedling age to below 30 days will depress yield.

(vii) PHOTOSENSITIVITY

175. An experiment in which three varieties, Siam 29, S.K. 48 and R.S. 34, were subjected to varying periods of long and short days was completed during the year and a full report will be published later.

176. Examination of summarised data for the variety Siam 29 from all over the Federation shows that the period from flowering to maturity is constant regardless of the natural day-length conditions. This period of ripening of the grain is approximately 35 days.

177. Experimental treatment with long days showed that during the first four weeks of growth the plant is not photo-periodically sensitive, since in continuous short days and in four weeks of long days plants behave alike; but thereafter, each subsequent increase of two weeks in long days gives a constant increase in time to flowering.

178. Examination of the apices of plants grown in natural day length has shown that the flowering primordia are formed when the day length is between 12 hours 12 minutes 30 seconds and 12 hours 10 minutes 42 seconds and that visible exertion of flowers takes place approximately 24 days later.

179. Further data show that the day length at sowing bears no relationship to the maturation period. There must be a cumulative effect of the shortness of the days (or length of night) and the darkness received over the pre-flowering period (i.e. after the insensitive period and before the formation of flower primordia) must reach a certain amount before flowering will commence.

(viii) SEED DORMANCY AND VIABILITY

180. Investigations on the period of dormancy of padi seed have shown that it is nearly always less than 10 weeks and thus not likely to be of importance to padi planters who do not plant a follow-on off-season crop. Pebifun, the non-photosensitive Taiwan variety used in double cropping areas, has a negligible dormancy period and a germination percentage in excess of 80 can be expected within seven days of harvest.

181. A storage experiment showed that seed can retain its viability for at least $3\frac{1}{2}$ years when stored in an air-conditioned room, or for two years in sealed containers with calcium chloride, whereas in normal storage conditions there is a rapid decrease in viability after eight months.

(ix) NUTRITIONAL STUDIES

182. (a) *Penyakit Merah*.—(i) *Fertiliser Experiments*.—During the period March to June, 1955, soils were inspected in 28 padi areas in the Federation where *Penyakit Merah* had been reported during the last two years. Notes were taken on the physical structure of the soil and samples were collected from each horizon, to

a depth of 4 feet, for chemical analyses. From these 28 areas, 19 were selected for a fertiliser experiment. This was set up to test the effect on the severity of *Penyakit Merah* of phosphate, dolomitic limestone and sodium nitrate (for its addition of oxygen to the soil) when applied as fertiliser, together with foliar sprays of phosphorus and of manganese salts.

183. At intervals, leaf and root samples were collected from areas adjacent to the manured plot for chemical analysis and study of nematode infestation.

184. Nematodes have been found in the roots of plants from all areas, but no correlation could be obtained between the number of worms and the foliar symptoms of *Penyakit Merah*. Nematodes were also found in roots from areas in which no *Penyakit Merah* has been reported in the last two years. It was found that the majority were of a parasitic type, *Radopholus oryzae* v. Breda de Haan, and the rest were a saprophytic *Chronogaster* sp.

185. (ii) *Varietal Resistance*.—Varietal trials have been set out on six padi test stations and in tanks at Kuala Lumpur to test resistance to *Penyakit Merah*. The varieties being tested are: Siam 29, Seri Raja, Reyong 6, Mayang Sagumpal, Machang and Serendah Kuning. Of the five tanks being used to test varietal resistance, three have been covered to test the effect of stagnant water.

186 (iii) *Other Nutrients*.—A pot experiment was also tried in which manganese sulphate, sodium acid phosphate or ferrous sulphate was added to the soil in the presence of stagnant water. No *Penyakit Merah* occurred and yield data is not yet available.

187. Plants were grown in sand cultures in the presence of excess chelated iron or aluminium to ascertain whether the resulting leaf symptoms corresponded to those of *Penyakit Merah*. Severe symptoms to toxicity were obtained at 50 and 100 p.p.m. of iron but they were not the same as *Penyakit Merah* symptoms. Excess aluminium caused almost no abnormalities. The highest concentration was 4 p.p.m. of aluminium. The variety Pebifun was more susceptible to an excess of either element than was Radin Siak 34 or Serendah Kuning.

188. Visits were made to areas in Kedah, Perak, Selangor and Malacca, where *Penyakit Merah* had been serious in the past two or three seasons. Soil profile pits were dug and the profiles examined and sampled. So far there is no indication that *Penyakit Merah* is connected with any particular soil type. The soils examined varied from recent sea clays to very old leached alluvial soils. Off-season drainage in the Kedah soils was excellent; soils in Krian and Malacca had very poor off-season drainage.

189. (b) *Toxicities*.—Plants were grown in sand culture in the presence of excess salt (Na Cl) or arsenic. This experiment was undertaken to determine the toxic levels of these chemicals, the former being used because of the effect of sea water in coastal padi areas and the latter because of the contamination by As of the effluent water from some tin mines that is later used for padi irrigation. The experiment is still in progress but the plants in 3,200 and 6,400 p.p.m. of the Na all died. The threshold value

appears to be around 1,600 p.p.m. of Na for Siam 29. Further tests have just been started using two salt-tolerant varieties, Chubai 18 and Arong.

190. Padi seems to be very tolerant of high concentrations of As. The variety Siam 29 just survived at 10 p.p.m. of As., but all plants in 5 p.p.m. or less appear to be as good as the control.

191. A preliminary sand culture experiment was carried out in which plants were grown in pH 2.5, 4.0, 5.5, 7.0 and 8.5. Plants in pH 2.5, which were transplanted when eight days old, grew very poorly and died after 51 days in the solution. The total fresh weights of plants at the flowering stage were, in gm., pH 4—115.2, pH 5.5—99.3, pH 7.0—90, pH 8.5—77.9. The experiment is continuing.

192. (c) *Water Control*.—An experiment using varying water conditions in tank cultures was completed. The depth of water had no effect on final height but stagnant water produced shorter plants. Deep water caused more rapid growth in height in the early stages and slower growth in the later ones. The deeper the water the fewer were the tillers produced. Varying the water depth variously affected the intervals between tillering, initial flowering, final flowering and maturity but had little effect on total maturation period. Radin China 4 was more sensitive in this respect than other varieties. Yield was confused by a stem borer attack which had a differential effect on treatment. When the stem borer was disregarded, by making comparisons on the estimated total yield (mean weight of grain per ear x the total number of tillers produced), there was little difference between treatments with the exception of the effect of 12 in. of water and of vertically moving water, both of which produced considerably lower yielding plants than the controls.

193. Ear weight was highest (4.0 gm.) in 8 in. of water and lowest (3.3 gm.) in vertically moving water.

194. In a second experiment in this series, only one variety, Pebifun, was used and the treatments were:

1. Control—4 in. of surface water;
2. as (1) but soil dried for harvest;
3. water allowed to stagnate (depth 4 in.); and
4. soil saturated until all tillers were formed and then water raised to 8 in.

Plants in Treatments 2 and 3 were shorter (as measured from the soil surface to the leaf tip) than in the control, being 6.1 cm. and 7.6 cm. shorter respectively on the last measurement. The length of leaf lamina in Treatment 4 (top of leaf sheath to leaf tip) was 2.8 cm. less than the control on the last measurement.

195. Treatments 3 and 4 gave an 11.6 and a 12.2 per cent. increase in yield respectively when compared to the control, both increases being just short of significance. There was only a small and insignificant variation between treatments in total tiller numbers. Mean numbers of days to maturity were (Treatment 1) 125, (2) 124, (3) 127 and (4) 129.

196. A third test in this series has just been commenced. It is designed to test the effect of two rates of running water (one being five times the rate of the other) and the effect of fresh water as compared with completely stagnant water.

(x) PESTS

197. (a) *Stem Borers*.—Pot experiments to test the efficiency of insecticides against stem-borers (*Chilotraea*, *Schoenobius*, *Chilo* and *Sesamia*) proved that EPN 300, endrin and dieldrin were about equally effective. Further tests with systemic insecticides and endrin have now been terminated on account of their high toxicity to fish. Field trials are now being carried out with DDT, BHC and dieldrin at various rates.

198. Two grasses and one sedge serve as alternative host plants for the caterpillars which carry over during the off-season on volunteer padi. Ecological mapping of a selected area in Krian, Perak, fluctuations in borer population and inter-varietal susceptibility to damage are being studied.

199. (b) *Leptocorisa acuta*.—Good results were obtained in Kelantan against the green bug using a portable pulse-jet machine emitting a fog of 25 per cent. DDT in oil.

200. (c) *Patanga succincta*.—A second outbreak of the Bombay Locust on 20 acres of hill padi in the interior of Perak was checked by spraying 0.05 per cent. dieldrin. It was found that DDT bran bait was unattractive to the hoppers.

201. (d) *Radopholus oryzae*.—The identity of the nematode found associated with rice roots has been confirmed. This eelworm was reported in Krian in 1911 under the name of *Tylenchus*.

(xi) DISEASES

202. (a) *Seed Borne Diseases*.—Experiments commenced in 1954 to investigate the advantages of fungicidal dressing of rice seed were continued. Both laboratory pot tests and field nursery trials were included; organic mercurial fungicides were almost exclusively used. Various aspects of the subject were studied and from work so far completed the following tentative conclusions can be drawn:

- (i) seed dressing usually results in an increase in percentage germination, the mean increase being 10 per cent. In some cases treatment resulted in decreased germination and it appears that rice seeds are easily damaged by overdosage;
- (ii) treatment resulted in many cases in increased seedling growth. This was especially noticeable during early growth but became less obvious later;
- (iii) whether seed was treated before or after soaking was immaterial;
- (iv) fungicides were applied both as dusts and liquids but the former are preferable as liquids tend to cause damage and depression of growth; and

- (v) when fresh, well-stored seed giving a high percentage germination is used, there appears, in general, to be little or no advantage in using a fungicidal seed dressing. If, on the other hand, old seed of reduced viability has to be planted, seed dressing can give worth-while results.

203. Isolations from rice grains from different localities have been made to discover what fungi infect the grains. *Trichoconis padwickii* has been isolated from each of six samples and *Helminthosporium oryzae* from all but one. Other fungi isolated include *Pestalotiopsis disseminata*, *Trichothecium roseum*, *Curvularia* spp. and *Fusarium* spp. as well as species of *Aspergillus* and other moulds.

204. Tests to find which of these fungi are capable of attacking germinating seeds and young seedlings have also been carried out. *Helminthosporium oryzae* is by far the most virulent parasite: other pathogenic species are *Trichoconis padwickii* and *Curvularia* spp.

205. (b) *Other Diseases*.—No new disease of padi was observed during the year but outbreaks of several diseases were reported from different localities. Blast (*Piricularia oryzae*) caused damage to nurseries in the south of Perak and was also observed in Negri Sembilan. Sheath Blight [*Corticium (Rhizoctonia) solani*] and False Smut (*Ustilaginoides virens*) occurred in Kedah and Stem Rot (*Sclerotium oryzae*) was reported from Malacca.

2.—OIL PALM

(i) BREEDING AND SELECTION

206. (a) *Breeding*.—With the promise, from certain oil palm estates, of land on which to plant further oil palm experiments, a new series of controlled pollinations between selected palms of various types has commenced. The initial aim of the programme is to produce the progenies listed below in sufficient quantity for most of them to be planted on four estates in the Federation by 1959. To this end a number of pollinations have been made this year and some seed has already been harvested and planted in sand beds at the Federal Experiment Station, Serdang:

Pedigree	Total No. of Progenies to be produced for one Host Estate	No. of Different Crosses made, 1955	No. of Progenies in Sand-bed, 1955
DUMPY—			
Dumpy selfs	8	4	1
Dumpy × Dumpy controls ...	—	6	2
SEMI-DUMPY—			
Dumpy × other short palms ...	20	8	—
Semi-Dumpy × Dumpy ...	3	4	2
Semi-Dumpy × other short palms	5	3	—
Semi-Dumpy × Semi-Dumpy ...	3	—	—
Semi-Dumpy × Tall palms ...	3	—	—
Semi-Dumpy × Pisifera ...	5	—	—
Dumpy × Tall palms	8	—	—

Pedigree	Total No. of Progenies to be produced for one Host Estate	No. of Different Crosses made, 1955	No. of Progenies in Sand-bed, 1955
TALL—			
Tall selfs	6	3	—
Tall × Tall	40	7	—
Tall × Pisifera	20	20	—
Pisifera × Pisifera	3	3	—

207. Following reports of evidence in West Africa of the accidental out-pollination of supposedly control pollinated oil palm flowers because insufficient precautions were taken, the pollination technique at Serdang has been much improved. The new method includes the bagging of male as well as female flowers, storage of pollen from different palms in separate desiccators, pollen-proofing the canvas bags with latex, and dusting the female flower with an insecticide before it is bagged. These precautions, combined with the time taken in stripping the flower sheaths completely away (and often the subtending and adjacent fronds as well), have very considerably increased the amount of time spent on pollination work.

208. Up to the present only two fertile Pisifera palms at Serdang have been supplying all the pollen used in the recent breeding of "Tall" Tenera palms. Scaffolding has now been erected round the 40 ft. tall Pisifera palm 36/21 and it is hoped that pollen from this additional source will soon be available.

209. Arrangements have been made for the planting at the Federal Experiment Station, Jerangau, of a new oil palm trial (0.25). In this trial, seven semi-Dumpy Tenera progenies are to be tested against a control of Dumpy Deli palms. The plots of Dumpy palms are to be surrounded by a double guard row of other Dumpy palms to prevent their being overshadowed by the taller Tenera palms. Two replications in this experiment had been planted by the end of the year.

210. A two-acre plot in Field 20 at the Federal Experiment Station, Serdang, is being progressively planted up with seedlings grown from seed imported from the Institut de Recherches pour les Huiles et Oleagineux (I.R.H.O.), West Africa. These seedlings originate from fertile Pisifera × Pisifera and Tenera × Tenera pollinations, and some 30 had been planted by the end of the year.

211. Ten acres of land under old coconuts on an estate in Selangor has been cleared in preparation for the planting of oil palm experiment (0.26) in which five Tenera progenies are to be tested against a control of Dumpy Deli palms, which will also be protected by guard rows. Two of the Tenera progenies, and the Dumpy control, are to be of the same pedigree as those planted in Trial 0.25 at Jerangau.

212. (b) *Selection*.—The yield of the various "Elmina" progenies growing in Fields 3A and 4 at the Federal Experiment Station, Serdang, is given below. It will be noticed that the

Dumpy palms in Field 4 are yielding much less than those in Field 3A. Soil fertility may account for this in part but the difference is attributed mainly to the overshadowing of the Dumpy palms in Field 4 by neighbouring tall palms.

Expt. No.	Field	Progeny	Total Weight of Bunches, 1955 (tons per acre)	Mean Bunch Weight (lb.)
0.1	4	E. 45	2.9	33
		E. 93	2.9	27
		E. 200	3.1	46
		E. 211	4.7	38
0.2	4	E. 97	3.4	27
		E. 152	3.2	36
		E. 207	3.2	48
		E. 216	4.7	39
		E. 268	6.0	49
Not replicated	4	E. 268	4.2	39
		E. 366	5.2	41
		E. 120	5.8	43
		E. 206 (Dumpy)	4.0	38
Not replicated	3A	E. 206 (Dumpy)	7.2	48
		E. 152 × 206 (Semi-Dumpy)	6.5	56
		E. 268 × 206 (Semi-Dumpy)	5.5	55

Summary.—

Field	Palm	Bunch Yield (tons/acre)	Oil Yield (tons/acre at 15% extraction)
3A ...	Dumpy ...	7.2 ...	1.10
3A ...	Semi-Dumpy ...	6.0 ...	0.90
4 ...	Tall ...	4.9 ...	0.74

213. The unreplicated observation plot (Trial 0.4) planted in September, 1951, on an estate in Selangor with "Backcross-Dumpy" palms was brought into bearing in May. The total weight and number of bunches taken from each progeny have been recorded at each harvest.

YIELD DATA FOR THE 15-WEEK PERIOD 5TH SEPTEMBER
TO 19TH DECEMBER, 1955

Progeny	Total Bunch Weight (tons per acre)	Mean Bunch Weight (lb.)	Yield of Oil (tons/acre at 13% extraction)
<i>Dumpy × Semi-Dumpy.—</i>			
1.1 × 12.3 ...	1.91 ...	10.9 ...	0.25
1.1 × 14.2 ...	1.85 ...	12.3 ...	0.24
1.7 × 12.3 ...	2.15 ...	12.9 ...	0.28
1.7 × 14.2 ...	1.42 ...	13.7 ...	0.19
3.5 × 12.3 ...	1.85 ...	11.1 ...	0.24
3.5 × 14.2 ...	1.74 ...	12.8 ...	0.23
<i>Semi-Dumpy × Semi-Dumpy.—</i>			
10.8 × 14.2 ...	2.02 ...	16.0 ...	0.26

214. While little importance can yet be given to these figures, since they cover an inadequate period of time, it may be of interest to note that progenies of 12.3 and 1.1 seem to be the earliest in bearing and the progenies of 1.7 and 14.2 have, like their parents, relatively large bunches.

215. The two experiments (0.5 and 0.6) planted on an estate in Perak in November, 1951, were both brought into chisel harvesting in May. Only the records for the first four months of bearing are available (3 5/12 to 3 9/12 years of age).

Expt. 0.5 Dumpy Palms. Four months yield = 261 lb. oil per acre at 13 per cent. extraction.

Expt. 0.6 Backcross-Dumpy Palms. Four months yield = 276 lb. oil per acre at 13 per cent. extraction.

(ii) GERMINATION

216. While the average germination of pedigree seed in the Serdang sand beds remains at only 50 per cent. it is axiomatic that an improved technique is desirable. In an exploratory experiment which has been planted in the sand beds, the seeds have been subjected to various pre- and post-sowing treatments. Results are inconclusive and have failed to show how the normal method of seed germination can be easily improved. The use of a heated seed germinator is being investigated. It was decided that paraffin would be the most suitable heating agent, and a germinator was built using a modified lamp which burns an average of three-quarters of a pint of oil per day. The capacity of this prototype germinator is only 4,000 seeds, mixed with the same volume of broken charcoal. The seeds were kept at a temperature between 39°C and 42°C during the last few weeks of the year, but earlier the temperature once reached 45°C. No seed germinated during the first month of the experiment.

(iii) CYTOLOGY

217. Root tips of Deli, Tenera and Pisifera palms have been examined. The Deli and Tenera types showed normal behaviour during mitosis but in the Pisifera there appeared to be a strong tendency for very slow and incomplete separation of chromosomes to the poles. This is interesting in view of the sterility shewn by some Pisifera palms.

(iv) PROCESSING

218. New work has been mainly concerned with a study of the condition for optimum extraction and quality of palm kernels. This must be done while maintaining, as near as possible, the optimum extraction of pericarp oil, which is the primary product.

219. Field observations suggest that the large variations in the quality of Malayan kernels may be due to non-uniformity of the early process conditions. The correction of these faults is largely a matter of elementary steam engineering rather than of specialised research.

220. Experiments carried out in the laboratory indicate that, given good factory conditions, heat penetration of the bunch

is rapid, and only short heating times are necessary to inactivate enzymes in the kernels. Such kernels are stable in storage and of good, white colour. Special analyses of pericarp oils of Tenera and Deli varieties have been carried out. In six replicates of each there were no significant differences.

(v) INSECT PESTS

221. *Bagworms*.—Damage to leaves caused by *Cremastopsyche pendula* Joannis continued to occur on an estate in South Perak. As a number of hymenopterous parasites are present, resulting in 16 to 52 per cent. larval parasitism, calcium arsenate dust was used instead of chlorinated hydrocarbons, which have long residual effects on the fronds of the palms.

(vi) DISEASES

222. A disease of young oil palms occurred on an estate in Johore. The disease began as small leaf spots which later coalesced to form large dead areas. In heavy attacks the seedlings were killed. Two fungi, species of *Gloeosporium* and *Curvularia*, were isolated from diseased leaves and the *Curvularia* was proved to be pathogenic. The same fungi were also isolated from seedling leaf spots at the Federal Experiment Station, Serdang.

223. Specimens of oil palm bunches extensively attacked by *Marasmius palmivorus* were received from an estate in Johore. The unripe bunches were extensively invaded by the fungus.

224. A large number of palms on a Selangor estate were affected by leaf base wilt. In this disease, which is thought to be physiological in origin, the older leaf stalks bend over near the base at an acute angle. Fruit bunches formed in the axils of such leaves tend to abort. Unlike Crown Disease, the heart leaves are not affected.

3.—COCONUT

(i) SELECTION AND BREEDING

225. Collection of open-pollinated coconuts from selected trees at the old Port Swettenham Station has continued throughout the year. The total number of nuts obtained so far from the 37 mother trees is 1,846, of which 1,185 have germinated and been sent to nurseries at the Federal Experiment Stations at Degong and Telok Bharu, both in Perak. No field planting has as yet taken place.

226. As a prelude to production of controlled-pollinated nuts, experiments have been carried out at Kuala Lumpur to ascertain the duration of male and female flowering phases in tall, semi-tall and dwarf palms, and to determine whether self-pollination can occur naturally. In the tall palm studies, the male flowers are open for 20 days with maximum production of pollen after eight days. One male inflorescence immediately follows another so that there is no period in which pollen is not available. The female flowers are receptive for two days only, at a time corresponding to the third and fourth days after opening of the

male flowers, when a large amount of pollen is available. There is the probability therefore that tall palms can be naturally self-pollinated.

227. In semi-tall palms the male flowering period is about the same (20 to 21 days) but there is an interval of two days between male phases. The female flowers are receptive for two days at a period corresponding to the first two days of the male phases, when very little pollen is present. The chances of self-pollination in these semi-tall palms is therefore remote.

228. Observations on dwarf palms are still in progress, but from results so far obtained it appears that self-pollination is probably the normal occurrence.

(ii) INSECT PESTS

229. (a) *Artona catoxantha* Hamps.—Only one outbreak was reported during the year (from Province Wellesley) and it died out at the end of February. There had been up to 51 per cent. parasitism by the Tachinid *Ptychomyia remota* Ald. at the end of 1954.

230. (b) *Chalcoscelis albiguttata* (Snell.).—Rather severe damage occurred over 150 acres of a coastal estate in Selangor due to the Gelatine Grub, *Chalcoscelis albiguttata* (Snell.). A power duster was used to apply benzene hexachloride (0.65 per cent. gamma BHC) at 20 lb. per acre and this controlled the outbreak. Parasitism by the Ichneumon *Gotra* sp. was low.

231. (c) *Aspidiotus destructor* Sign.—Injury to seedlings in Perak by the scale *Aspidiotus destructor* Sign. was checked by spraying with petroleum emulsion. New parasites reared were *Aspidiotophagus citrinus* Crawf., *Aphytis chrysomphali* (Mercet.), *Casca parvipennis* Gahan and *Spaniopterus crucifer* Gahan and the predaceous beetle *Cybocephalus semiflavus* Champ.

232. (d) *Oryctes rhinoceros* L.—Laboratory tests with soil insecticides against larvae of the Rhinoceros Beetle indicated that aldrin at 0.48 per cent. and dieldrin at 1 per cent. gave a 95 per cent. mortality and BHC at 0.03 per cent. a 90 per cent. mortality in 20 days.

233. (e) *Plesispa reichei*.—Damage was reported from Johore by this leaf eating beetle.

(iii) DISEASES

234. An obscure chlorosis, leaf-rot and die-back of recently planted out dwarf coconuts was investigated on an estate in Perak. A species of *Curvularia* was isolated from diseased areas but the primary cause of the trouble was possibly poor drainage.

4.—PINEAPPLE

(i) SELECTION AND BREEDING

235. The selection stocks of Singapore Spanish and Sarawak pineapples have been maintained at the Federal Experiment Station, Jalan Kebun, Selangor, and duplicate clones of the former variety established at the Federal Experiment Station, Alor Bukit, Johore.

236. (a) *Singapore Spanish*.—Records from the first crop at Jalan Kebun have been examined and some clones have been earmarked for discard. Records of the second crop are now being taken and when completed it should be possible to reduce the number of selections considerably and replant the experiment with a large representation of each selected clone.

237. (b) *Sarawak*.—Altogether 147 plants in the mass selection plot at Jalan Kebun have been selected for further trial. The remainder (456) have been discarded on various grounds such as long maturation period, undesirable fruit or vegetative characters, etc. Approximately 10 per cent. of the selected plants have basal slips, a character which is not common in this variety, where the normal method of reproduction is by ground or aerial suckers only.

238. (c) *Smooth Cayenne*.—The 25 plants imported from South Africa have fruited and been replanted. The fruit is very similar to that of the Sarawak variety. The South Australian Smooth Cayennes have been established at Alor Bukit and are growing well.

(ii) CHEMICAL ANALYSIS

239. Work has continued throughout the year on the analysis of fruits grown on peat soil at the Federal Experiment Station, Jalan Kebun. Current findings are:

(a) there is little chemical difference between fruit of the Sarawak and Smooth Cayenne varieties grown on peat soil. In this case the Smooth Cayenne was of South African origin. Both have a higher sugar content than the Singapore Spanish variety when grown on unmanured plots;

(b) Singapore Spanish fruit showed a response to potash manuring of increased sugar content, increased acidity and hydrogen ion concentration. Recent results suggest that this response is dependent on adequate supplies of other plant nutrients, but, given the correct conditions, the sugar content of the Singapore Spanish can be improved to a level approaching that of the Sarawak/Cayenne; and

(c) sugar content of all varieties increases through the stages of ripening, as indicated by skin colour.

240. The work on fresh fruit has been extended by the installation of a deep-freeze unit. Aliquot samples of the edible portion of fruits are frozen in polythene bags within 24 hours of harvest. Thus the difficulties of seasonal peaks have been eliminated.

241. A study of the chemical changes during fruit maturation has been started. So far only fruits from discard rows have been available and only low significance results have been obtained.

(iii) CANNING RESEARCH

242. (a) *Waste Juice for Canning Syrup*.—Field tests of recovery of waste juice for canning syrup have been carried out using the new experimental filter press. Further work is in progress.

243. (b) *Juice Canning*.—A series of trials has been run to investigate the following:

- (i) the quality of juice obtainable from the different parts of the fruit normally used for this purpose;
- (ii) yields obtainable;
- (iii) the effects of homogenization; and
- (iv) the relationship between fruit maturity and juice quality.

244. Singapore Spanish fruit was used throughout and Hawaiian juice used as a reference sample. All raw material was chopped, preheated, pressed and finished (screened), centrifuged, de-aerated and canned.

245. The main results were as follows:

- (i) sugar content and acidity of Malayan fruit juice averaged 7.3 per cent. sugars and 0.53 per cent. acids (Hawaiian: 14.5 per cent. and 0.88 per cent. respectively);
- (ii) attempts to use cores and whole skins for juice were failures;
- (iii) immature fruit gave juice of 4.1 per cent. sugars and 0.36 per cent. acids, compared with best Malayan juice at 8.6 per cent. sugars and 0.63 per cent. acids. The latter juice was prepared from eradicated pulp, "tops and tails" and trimmings, representing fruit recovery in excess of normal canning efficiency;
- (iv) the best quality fruit gave the best juice and the best yield; and
- (v) in this series of trials, homogenization produced no significant difference in sedimentation rate or flavour.

246. (c) "*Paraffin*" *Off-Flavour*.—Experiments were laid down in 1954 to test the effect of variations in elapsed time between harvest and canning on the incidence of the off-flavour, a defect which develops during storage. Affected batches contained from 10 to 30 per cent. tainted cans, which was higher than anything produced in other experiments to investigate this problem. It was found that:

- (i) staling of the fruit between harvest and canning is not a factor in producing the off-flavour;
- (ii) the results suggested that a precursor of the off-flavour substance is due to growing conditions; and
- (iii) once the "precursor" is present, exposure (up to 4 hr.) of cut fruit to the atmosphere between preparation and processing produced a significant increase in off-flavour development in storage.

247. A new series of experiments to test the above conclusions has been started.

248. (d) *General*.—During the fourth quarter, a new series of experiments was initiated to investigate the possible yield of prepared material from each of the four leading varieties of pineapple, and the relationship between maturity and product quality for the same four varieties. This work is still in progress.

249. Modifications have been made to the experimental size-grader for pineapples to enable it to be further tested in the 1955-56 "winter" season. This is the next important stage in cannery mechanisation, and is also important in the efficient utilization of fruit material in mechanical peeling and sizing machines.

(iv) INSECT PESTS

250. *Mealybugs*.—A field trial was laid down to determine whether pineapples would remain free from the mealybug *Dysmicoccus brevipes* (Ckll.) after fumigation of the slips with methyl bromide and spraying of the soil with dieldrin at 0.08 per cent. actual at 150 to 200 gallons of spray per acre. However, mealybugs were observed in from two to five months after spraying of the peat soil.

251. Immersion of slips for seven hours in aldrin emulsifiable concentrate, 0.1 per cent. actual, gave a 100 per cent. kill of mealybugs.

252. In pot experiments in which plants were inoculated with mealybugs collected from unwilted and wilted pineapples, symptoms of quick wilt appeared after eight weeks in plants receiving the mealybugs from wilted pineapples (13 out of 15 plants). Experiments will be made to see if a virus is responsible for this condition.

(v) DISEASES

253. (a) *Fruit Collapse (Fruit Rot, Ghost Fruit)*.—The cause of this serious disease, which has so far only been observed in Johore, has been shown to be a bacterium, a species of *Erwinia*. Numerous isolations from affected fruit have been made and in all cases the only pathogenic micro-organism isolated has been this one species. Typical symptoms of the disease have been produced by inoculating immature fruits with pure cultures of the bacterium.

254. The variety Singapore Spanish is very susceptible to Fruit Collapse but, as they are not commonly grown in the areas where the disease occurs, little is known of the susceptibility of other varieties, although the Sarawak variety is reputed to be immune in the field. Laboratory inoculation tests have indicated that the varieties Selangor Green and Mauritius are as susceptible as Singapore Spanish but that the variety Sarawak is very resistant to the disease, although not completely immune.

255. Observations were made in the Pontian area of Johore to see if Fruit Collapse may have been carried by an insect vector. Three beetles were found generally associated with ripe fruits, viz., the Cetoniid *Glycyphana sinuata* Wall. and the Nitidulids *Carpophilus* sp. near *foveicollis* Murr. and *Haptoncus ocularis* Frm. Nothing has been found to indicate that these beetles are vectors of the disease.

256. A field experiment to discover whether Fruit Collapse can be controlled by spraying the fruits with bactericides is being laid down in Johore.

257. (b) *Heart Rot*.—It is already known that this disease of young plants is caused by a bacterium. During the period under

review it has been demonstrated that the bacterium causing Heart Rot is identical with that causing Fruit Collapse. Not only are they similar morphologically and in cultural characteristics but, in addition, isolates from fruits affected by Fruit Collapse can cause Heart Rot, while isolates from young plants affected by Heart Rot can cause Fruit Collapse.

258. Heart Rot, previously only recorded from the Pontian area of Johore, has recently also been found in the Ayer Hitam district of that State and in the Sekinchang area of Selangor. In both cases examination, isolation and inoculation showed that the disease was caused by the same species of *Erwinia*.

259. Heart Rot, previously considered a minor disease, now assumes greater importance as diseased plants, unless destroyed, may act as reservoirs of Fruit Collapse infection.

260. Field experiments to discover whether this disease can be controlled by spraying with a bactericide or an antibiotic are being commenced in Johore and Kuala Lumpur.

261. (c) *Basal Slip Rot*.—A basal rot of pineapple slips, occurring during the hardening off period before planting, and caused by a species of *Thielaviopsis*, was found on planting material from Selangor. About two per cent. of the slips were affected.

5.—CACAO

(i) SELECTION

262. (a) *Trinitario*.—(i) *Indonesian*.—Full experimental results for 1955 from progenies under trial in Field 47a at the Federal Experiment Station, Serdang, are not yet available but the data obtained over the 12-month period July, 1954, to June, 1955, are given below:

PROGENY TRIAL COMPARING INDONESIAN TRINITARIO AND AMELONADO

(Expt. No. C. 6 FESS. 115. Planted Sept., 1950)

(data for the 12 months July, 1954, to June, 1955)

Variety	Per cent. in Bearing of Total Planted	Yield of Dry Cocoa Per Acre (Assumed 40% Extraction) lb.	No. of Pods Per Tree	Weight of Wet Cocoa Per Pod gm.	Bean Weight gm.	No. of Beans Per Pod
A. Getas 8	72	459*	11*	105	3.3***	32***
B. Djaterongo 1.	86	598	15	102	3.5***	29***
C. Poerboyo Red	73	444*	12	90***	2.7	33***
D. Poerboyo Green	65	409*	11*	89***	2.4**	36**
E. Suzannasdaal	88	780	21	98**	2.7	36**
F. Amelonado	85	811	19	110	2.8	40
MSD at 5% pt.	—	294	7	91	0.2	3
C. Ve. as % G.M.	—	42	40	7.5	1.8	6.2

Design and Plot Size ... 6×6 Latin Square

20 plants per plot planted 10'×10'
(plots 40'×50').

Yield is calculated as the product of "cacao per pod" and "pods per tree". "Cacao per pod" is determined from a sample of 15 pods taken over an indefinite period. Differences from Amelonado significant at * = 5%, ** = 1%, *** = 0.1%.

263. Amelonado (F) owes its superior yield not only to a large number of trees in bearing and pods per tree but, surprisingly, to the highest mean weight of cocoa per pod. Suzannasdaal (E) had more trees in bearing and more pods per tree but the pods were smaller than those of Amelonado.

264. Although the variety Suzannasdaal (E) shows an extremely wide range of pod type, many of the pods are almost identical with those of Amelonado. It is possible that the Suzannasdaal parent tree was an Amelonado $\times$ Criollo hybrid. This is supported by the evidence of pod type, bean size, pod number and compatibility. For this reason it is probably the variety from which an improved true breeding strain can most easily be obtained.

265. The number of trees selected from each progeny according to established selection criteria is as follows:

Progeny		Trees Selected for Clonal Trial		Trees Selected for Potential Parents
A. (Gt. 8)	...	12 (8%)	...	6 (4%)
B. (Dr. 1)	...	20 (11%)	...	9 (5%)
C. (Pr. R)	...	9 (6%)	...	6 (4%)
D. (Pr. G)	...	6 (5%)	...	4 (3%)
E. (Suz.)	...	14 (7%)	...	4 (2%)

266. The most outstanding trees at present are:

Tree No.	Variety	Total No. of Pods Harvested To-date (4½ years old)	Weight of Cocoa per Pod gm.	Calculated Total Yield of Dry Cocoa lb.	
269	E	137	110	13.3	
1148	C	133	110	12.9	43 pods at one harvest
466	D	144	100	12.7	
230	D	123	110	11.9	White beans
200	B	114	100	10.0	" "
173	B	32	170	4.8	
594	A	32	170	4.8	
724	F	88	120	9.3	Amelonado tree yield- ing most pods
837	F	69	130	7.9	Amelonado tree yield- ing most cacao per pod.

267. (ii) *Local Trinitario*.—In Experiment FESS. 97 (Field 46A) Amelonado has yielded more cocoa than the other varieties. The fresh beans of the “near-Criollo” varieties were heavier than Amelonado but had a lower extraction rate. Data for the experiment are given in the following table:

PROGENY TRIAL COMPARING “LOCAL” TRINITARIO AND AMELONADO

(Expt. No. C 5 FESS. 97. Planted March, 1950)

Varieties:

- (whole plots) A—Amelonado
- B—Trinitario “near-Criollo”
- C—Trinitario.

Progenies :

B—S. 15 × 68 Seven sub-plots of 15 trees each.

S. 15×43

C—S. 27×21 Five sub-plots of 10 trees each.

S. 27×43

S. 27×68 „ „

S. 47×21 Two sub-plots of 15 trees each.

S. 47×43 „ „

(data for the 12 months July, 1954, to June, 1955)

Variety	Per cent. in Bearing of Total Trees Planted	Yield of Dry Cocoa per Acre (assumed 40% extraction)	No. of Pods per Tree	Weight of Wet Cocoa per Pod	Bean Weight	No. of Beans per Pod
		lb.		gm.	gm.	
A.	87	431	13.5	117	3.0	39
B.	83	321	10.8	117	4.0***	29***
C.	87	254**	15.4	66***	3.0	22***
MSD at 5%	—	117	4.1	2.0	0.2	3
C. Ve. as % G.M.	—	30	26	4.4	4.1	10
15 × 43	74	259	8.3	115	4.1	30
15 × 68	92	383	13.4	119	3.9	29
MSD at 5%	—	NS.	3.8	NS.	NS.	NS.
C. Ve. as % G.M.	—	30	27	8.8	4.9	8.6
27 × 21	90	209	13.2	63	3.0	20
27 × 43	94	455	27.1	62	3.0	21
27 × 68	90	206	13.6	62	2.8	22
MSD at 5%	—	126	7.7	NS.	NS.	NS.
C. Ve. as % G.M.	—	30	29	12.0	5.9	9.0
47 × 21	70	146	8.5	89	3.3	21
47 × 43	80	181	9.5	80	3.3	24
MSD at 5%	—	NS.	NS.	NS.	NS.	NS.
C. Ve. as % G.M.	—	20	45	1.4	.0031	0.7

Design and Plot Size:

Randomised Block, Seven Blocks.

Irregular plots each containing 30 plants at 12' x 12' spacing.

Variety plots split for progenies.

Yield is calculated as in Experiment, FESS. 115.

*—P. 0.05. **—P. 0.01. ***—P. 0.001.

268. Although the statistical analysis does not show that Amelonado (A) has yielded significantly more than "near-Criollo" (B) during the last year, this is probably a reflection of the high coefficient of variation rather than the value of Variety B.

269. Unfortunately no exact figures for the extraction rate of dry cocoa from wet are available yet, but a small number of samples tested indicate that the low extraction rate inherent in the parental trees is also present in these progenies. While beans from Amelonado trees in this field have, after fermentation and

drying, yielded 38 per cent. of their wet weight, beans from selected trees of the near-Criollo variety have only yielded 22 per cent. This greater loss of weight by beans of local trees is only partly accounted for by their thicker and more watery mucilage; the cotyledons themselves seem to lose more than they should, so that it is difficult to obtain a sample of dried beans without a very wrinkled shell.

270. The low extraction rate almost compensates for the large fresh bean size of the near-Criollo varieties, but in order not to neglect this desirable characteristic, and also to exploit any latent hybrid vigour, a few trees from this trial are being crossed with other strains in the course of the breeding programme.

271. (iii) *West African*.—T. 9 remains the most promising type in this collection, which was planted in 1951. No really valid conclusions may be drawn from the results given below because of the lack of replication in this field, which is a valley with considerable soil heterogeneity. However, T. 9 has the reputation of being vigorous and is also showing this characteristic as buddings elsewhere in Malaya.

Type	No. of Trees Planted	Pods per Tree Harvested, 1955	Mean Weight of Fresh Beans per Pod gm.
T. 9 ...	315	0.37	115
U. 11 ...	159	0.12	136
E. 1 ...	137	0.02	108
TF. 1 ...	38	0.08	100
TF. 2 ...	70	—	—
B. 2 ...	42	0.09	146
N. 38 ...	42	—	—

272. (iv) *Ceylon*.—The number of pods harvested from these budgrafted clones cannot be used to make a valid estimate of their potential yield since the plants are of various ages and many pods have been destroyed by civets. It is of interest to note, however, that the weight of fresh beans per pod from these plants corresponds quite well with that obtained from pods of the mother trees.

Clone No.	No. of Plants	No. of Pods per Tree, 1955	*WEIGHT OF FRESH BEANS PER POD	
			Parent Tree gm.	Buddings gm.
480 ...	15	0.6	90	90
623 ...	15	1.2	110	120
714 ...	30	1.7	110	100
793 ...	30	1.8	100	120
1025 ...	30	1.4	180	130
1114 ...	15	4.5	130	120

* Except for the parent tree No. 1025, from which only one pod was available, at least 15 pods from each tree and clone were examined.

273. (v) *New Guinea (Keravat)*.—The growth of this material remains poor despite a reduction in the number of jungle trees under which it is growing. Only 29 pods have been harvested this year from the 300 four-year old trees.

274. (vi) *Trinidad*.—Open pollinated seedlings of ICS. 1, planted in 1951, have yielded only three pods this year while those of ICS. 7 and ICS. 9 in the same field have yielded none at all. This is the same field in which the West African Trinitario is also growing poorly.

275. In another field, open pollinated seedlings of ICS. 1 were planted in 1951 and their behaviour is more promising.

No. PODS PER SEEDLING, 1955 (PLANTED MARCH, 1951)	No. PODS PER BUDDING, 1955 (BUDDED MARCH, 1952)	WEIGHT FRESH BEANS PER POD	
		Seedling gm.	Budding gm.
7.0	0.7	117	103

Calculated yield of dry beans per acre :

seedlings = 310 lb. per annum

buddings (of unselected seedlings) = 27 lb. per annum

276. (vii) *Samoan*.—In 1951, 33 seedlings from one open pollinated pod of "Lafi 7" were planted in Field 47A at Serdang. Neither their yields nor pods are particularly promising but many of the trees produce white Criollo-type beans.

Weight of fresh beans per pod 94 gm.

Approximate calculated yield of dry beans
per acre 61 lb.

277. (b) *Upper Amazon*.—The seedlings from open pollinated Upper Amazon trees in West Africa continue to grow vigorously and to yield more cocoa for their age than any other variety at the Federal Experiment Station, Serdang. Their yield during the second half of the year was disappointing and so the annual yield has not risen to the expected level.

UPPER AMAZON

(planted in Field 50, October, 1952)

	No. of Pods, 1955	Wt. of Fresh Beans per Pod gm.	Wt. per Fresh Bean gm.	Calculated Yield of Dry Beans per Acre, 1955 lb.
Field Mean per tree	10	101	2.7	268
Tree No. 12 ...	31	120	2.8	989
Tree No. 13 ...	23	130	3.2	795

278. (c) *Selection Trials*.—In order to produce improved planting material for the grower as soon as possible, 90 of the most promising trees, from the 5-year old plantings at Serdang, were propagated as buddings in a preliminary clonal trial at the Federal Experiment Station, Jerangau.

279. The following table gives data for some outstanding selected trees in 1955:

Tree No.	Date Planted	Mean Weight of Fresh Beans per Pod	Mean Fresh Bean Weight	Equivalent Yield of Dry Beans per Acre	
				1954 lb.	1955 lb.
1148 (I.T.*)	Sept., 1950	110	3	2,400	3,200
466 (I.T.)	" "	100	3	3,292	2,105
173 (I.T.)	" "	170	5	1,106	716
Amelonado field mean...	" "	110	3	550	727
Amelonado yielding most in 1955		120	3	735	2,572
618 (L.T.†)	March, 1950	110	3	848	2,163
385 (L.T.)	" "	180	5	670	1,387
352 (L.T.)	" "	170	6	271	1,175
Amelonado field mean...	" "	120	3	347	443
Amelonado yielding most in 1955		120	3	1,435	2,137

* I.T. = Indonesian Trinitario.

† L.T. = Local Trinitario.

280. The Chemistry Division has now devised a standard microfermentation technique for the processing of beans from one pod so it is hoped that in future selection criteria may include "extraction rate of dry beans from fresh", percentage cocoa butter, percentage shell on nibs and even flavour.

281. One field at Serdang is being progressively planted with plots of five cuttings taken from each of the selected trees there. This "museum" is not replicated but is interplanted with plots of Amelonado. By the end of the year, 42 Trinitario clones and seven plots of Amelonado controls had been planted.

282. During September and October, the first two acres of a six-acre clonal selection block was planted at Jerangau and each of 90 selected Trinitario trees from Serdang was established, each selection being planted in two plots of 12 trees each. This simple replication, combined with the 20 interplanted plots of Amelonado, should enable an initial selection of the clones to be made before a full scale clonal trial is planted.

(ii) BREEDING

283. More than 1,000 controlled pollinations have been made to produce over 700 pods containing the seeds of 180 different progenies destined for trial at the Federal Experiment Station, Jerangau.

284. (a) *Hybrids*.—The 72 Nanay 32 (Upper Amazon) × Amelonado hybrid seedlings planted out last year have, after making a promising start, suffered severely from "die-back". Soil fertility in this field is thought to be very low.

285. It is unfortunate that the other field of hybrids (S. 15 × Amelonado) has suffered similarly. In this case the condition was thought to be aggravated by the dense over-head shade and severe root competition of the trees under which the

cacao was planted. Many of these trees have now been removed and a heavy dressing of fertiliser is to be given in a final attempt to stimulate healthy growth.

286. The very best trees have been used to initiate a breeding programme in which the initial emphasis has been placed on the production of various types of hybrid progenies which, if found to be valuable, could be produced by open pollination in seed gardens. Each of these progenies has one parent which is self-incompatible.

S. I. Parent.	S. C. Parent.
Trinitario	Amelonado
Trinitario	Trinitario
Upper Amazon	Trinitario
Upper Amazon	Criollo
Upper Amazon	Amelonado

287. (b) *Progeny Selection Block*.—The first 1½ acres of this 11-acre block was planted in November at Jerangau. The trial is designed as a randomised block with five replications and is intended to test the yield of 13 various cacao progenies against each other and the Amelonado control. The 13 progenies under trial are:

Type of Progeny	No. of Progenies
S.I. Trinitario × S.C. Trinitario ...	2
S.I. Trinitario × Amelonado ...	3
S.I. Trinitario × Upper Amazon ...	3
Criollo × Upper Amazon ...	1
Amelonado × Upper Amazon ...	1
S.C. Trinitario × Amelonado ...	1
S.C. Trinitario × S.C. Trinitario ...	2
Amelonado × Amelonado Control ...	1

288. In addition, some inter-Upper Amazon crosses have been made, and, as a precaution against the production of too many self-incompatible trees, there have been a few crosses of “S.C. Trinitario × S.C. Trinitario” and “S.C. Trinitario × Amelonado”.

(iii) PROCESSING

289. (a) *Microfermentation*.—This process is essential for selection work on cocoa in order that material from single pods may be produced to resemble normally fermented cocoa and also to study fermentation processes.

290. The multiple microfermentary at present in use is essentially a thermostatically-controlled, stirred waterbath. “Pyrex” beakers of 400 ml. capacity are used as fermentation vessels. Some baths had large heating elements but these have been replaced by standard, small, electric kettle elements so that up to eight vessels can stand in the bath without touching the heater. The thermostats are the Sunvic Type TS2 (6 in. stem), with relay, and the stirrer motor has to be of the continuous-rating type. A number of these baths are used and they are

controlled at either 35°C or 50°C. Variations in temperature/time treatments are made by transferring the vessels from one bath to another.

291. Each vessel holds a pod-full of beans (about 40), an inverted watch glass in the bottom accommodates "sweatings" and the beans are covered by, firstly, a layer of damp cotton wool and then a thick layer of dry cotton wool. The beaker is closed by a circle of 0.003 in. polythene held in place by a rubber band. Because of the steady temperature control and rapid equilibration, beans can be turned regularly to mix and aerate them without severe loss of temperature. Incubator thermometers had shown bean temperature to be substantially constant in all positions, so thermometers are no longer used, apart from one in the water for check purposes.

292. The standard fermentation procedure used for selected pods is as follows:

- (i) the pods are weighed and opened on the day of harvesting, after which the beans are placed on clock-glasses and exposed to the atmosphere for one hour; they are then placed in beakers as indicated above;
- (ii) the beans are kept at a temperature of 35°C for 3½ days and then at 50°C for 3 days;
- (iii) once each day the beans are tipped out into a dish, the sweatings discarded and the beans mixed gently by hand and replaced;
- (iv) fermented beans are washed and then dried on rattan trays in the sun for half an hour on the first day, one hour on the second day, for half a day (four to six hours) on the third day and then given full daily exposure until drying is completed (about seven to 10 days); and
- (v) the beans are then oven-dried at 55°C for 24 hours and stored for testing in screw-cap, 12 oz. bottles in an air-conditioned room.

293. So far, work has only been done with Amelonado material. Blended beans of this variety are now being subjected to varying temperature/time treatments, aeration, removal of carbon dioxide, etc. Simultaneously, samples are being taken for chromatographic separation of water-soluble pigments, with the object of finding some relationship between flavour development, fermentation conditions and measurable chemical changes in the beans.

294. (b) *Chocolate Preparation*.—All beans for testing are warmed to 100°C for 10 minutes and then roasted for one hour at 140°C. The roasted beans are shelled and nibs separated by hand. These nibs are reduced by pestle and mortar and ground by two passes through a Pascall triple-roll mill, wide settings being used for the first run (3 and 2 divisions) and closer settings (2 and 1½) for the second. The nib paste is moulded and cooled

and then bottled and stored as in the case of prepared beans. An average pod gives 30 gm. paste, of which 10 gm. is used for chocolate making. Fat is determined in the paste.

295. Chocolate is made by mixing together in a mortar 10 gm. nib paste, 13 gm. sieved icing sugar and 4 gm. de-odourised cocoa butter. The granular mixture is milled twice in the triple roll mill, with firstly a close setting ($2:1\frac{1}{2}$) and, for the second pass, with the rollers close enough to clear themselves of chocolate. The chocolate is warmed in a water bath, conched for 10 min. with a flexible stainless steel spatula on a glass plate, moulded in tinned-steel moulds and set in a domestic refrigerator overnight. After they have been removed from the moulds, the tablets are bottled as before and matured for one week under air-conditioning before tasting.

296. So far, cocoa butter kindly supplied by Messrs. Cadbury Bros., Ltd., has been used, but attempts have been made to produce locally a similar quality fat for test purposes. Solvent-extracted fats, both steamed and treated with active carbon, were not satisfactory. Fat from unfermented and unroasted beans possessed off-flavours, and the shelling and pressing were carried out only with great difficulty. Butter pressed from roasted, factory-fermented beans, and filtered through filter paper, was judged satisfactory. For testing, butters were mixed with sugar and then milled, conched and moulded as in chocolate testing.

(iv) INSECT PESTS

297. (a) *Conopia*.—Small cream-coloured caterpillars were found in February causing injury under the bark of trunks at the Federal Experiment Station, Serdang. These were bred out into clear wing moths later identified as a species of *Conopia*. Subsequently, the pods were found to be attacked by the caterpillars but only after previous pod injury by *Helopeltis theobromae* Miller. Injury to the seeds is fortunately very low. The caterpillars are parasitised by *Elasmus nephantidis* Rohwor. Later, *Conopia* was found in Trengganu on Trinitario pods; no trunk injury was seen. Fogging with DDT in oil or with other insecticides every two weeks should check both this caterpillar and the primary pest *Helopeltis*. The life cycle of *Conopia* occupies $6\frac{1}{2}$ weeks, of which $3\frac{1}{2}$ weeks are spent as larva.

298. (b) *Zeuzera coffeae*.—In order to check damage by this borer, a test was carried out which involved two sprayings of dieldrin (1.5 per cent. actual) at intervals of six months. However, borer damage in both the 100 control and 100 treated trees was much lower than last year, but the number of bore holes recorded was 2.6 times (16:6) as numerous in the control as in the sprayed trunks.

299. (c) *Cockchafer*.—Soil insecticides were tested against adult chafers (*Apogonia cribricollis* Burm. and *A. expeditionis* Rits.). 6.5 per cent. gamma BHC at 0.03 per cent. actual was found to be slightly more toxic than aldrin at 1 per cent. Dieldrin at 0.36 per cent. actual was less toxic than DDT at 0.3 per cent. actual.

300. (d) *Orthocraspeda*.—Severe defoliation was caused in a small area in Selangor by caterpillars of the Limacodid *Orthocraspeda trima* Moore, but it was quickly checked by DDT fogs and lead arsenate sprays.

(v) DISEASES

301. (a) *Seedling Leaf Diseases*.—Seedling leaves affected by leaf spots and rim blight are of common occurrence. Fungi, notably *Phyllosticta theobromae* and *Physalospora theobromae*, occur on these diseased areas but their pathogenicity is doubtful and nutrient deficiency is considered a more likely cause. To investigate this, seedlings are being grown in sand culture, using a complete nutrient solution and also solutions lacking one of the elements potassium, calcium or magnesium. In the minus calcium and minus potassium treatments, necrosis of the edge of the older leaves became visible when the plants were about three months old, and in the minus magnesium treatment a few weeks later. The appearance of the necrotic areas differed considerably in the different treatments.

302. Seedlings showing marked symptoms of zinc deficiency occurred at the Federal Experiment Station, Jerangau.

303. (b) *Other Diseases*.—Other diseases investigated during the year included die-back, associated with species of *Nectria* and *Fusarium*, and leaf spot, caused by *Gloeosporium* sp. The first definite recent occurrence of Pink Disease (*Corticium salmonicolor*) on this host was recorded from Trengganu.

6.—TEA

(i) SELECTION

304. Little progress has been made with the rooting of cuttings at Cameron Highlands and it has not yet been possible to establish any field trials of selected clones. Some 1,100 rooted cuttings are nearly ready for field planting and a preliminary trial is to be laid down in 1956.

305. There are nearly 20,000 other cuttings in nurseries but these were flooded during the heavy rains in November and December and percentage take may be seriously affected. It is proposed to establish a new nursery site on an area free from the risk of flooding and to use a modified rooting medium. Provided that this proves successful, a further field trial will be established in 1957.

(ii) INSECT PESTS

306. Two mites, both new pests for Malaya, have been recorded from leaves of highland tea. The pink mite *Acaphylla steinwedeni* Keifer was reported first, followed by *Brevipalpus* sp. near *phoenicis*. Injury to trunks by caterpillars of the Cossids *Xyleutes leuconotus* (Walk.) and *Zeuzera coffeae* Nietn. was reported from Cameron Highlands. The termite *Microtermes pallidas* Hav. was found on roots in the plains.

(iii) DISEASES

307. (a) *Blister Blight*.—Five spraying tests to compare the effectiveness of different fungicides against Blister Blight

(*Exobasidium vexans*) have been laid down at the Federal Experiment Station, Cameron Highlands. The fungicides being used are Shell Copper Fungicide (with and without sticker), two new experimental Shell fungicides, SR 406 (Captan), Phenyl mercury chloride, and Fungex and Cuprokylt (both copper compounds).

308. In another experiment, at the same station, to investigate the effect of Blister Blight attack on yield, little effect from spraying is discernible after five months' plucking.

309. (b) *Red Root Disease*.—The experiment at the Federal Experiment Station, Serdang, to compare different methods of soil treatment before replanting (removal of all roots v. normal uprooting, and use of creeping, non-susceptible cover crop v. woody, susceptible cover crop) has been concluded as the incidence of Red Root Disease (*Ganoderma pseudoferreum*) in the experimental area was very low and useful information was not forthcoming.

7.—RAMIE

(i) CLONAL TRIAL

310. This trial was concluded in March, a full report is being prepared for publication.

(ii) TIME OF CUTTING TRIAL

311. This trial has now entered its third and final cycle of 300 days and should be completed by June, 1956.

(iii) SPACING TRIAL

312. Eleven harvests have been taken from this trial, which was planted in July, 1953. A report is being prepared.

8.—FOOD CROPS

(A) Soya Bean

313. Variety trials of the selections from soya beans of Indonesian origin have continued at the Federal Experiment Station, Serdang. The trial, incorporating general purpose and "Spring" sown varieties, failed because of poor germination and some strains were lost. Results of the trial planted in late August (general purpose and "Autumn" sown) are not yet to hand but better growth has been obtained.

(B) Groundnut

314. The 125 selections planted in late December, 1954, were harvested in April. Unfavourable weather during the growing season, rat damage and heavy rain, with consequent sprouting just prior to harvest, caused a partial failure of the crop and comparative yield data were therefore unreliable for selection purposes. The 125 selections were replanted in May in two randomised blocks, plot size being three rows of 10 plants per row. Due to very dry weather just after planting, germination was very poor, especially in one of the blocks. The crop was harvested at the beginning of September and although yields were low, useful comparisons were possible.

315. The eighth crop of the 125 selections was then planted in two blocks as before, and under favourable conditions, and good germination in all plots was recorded. The crop is now growing very well and, provided there are no set-backs before harvest, it should be possible to reduce the number of selections after this crop.

(C) Sweet Potato

(i) SELECTION

316. The variety collection at the Federal Experiment Station, Serdang, has been maintained in duplicate, one replicate being used for selection of varieties giving a good yield of "tops".

(ii) INSECT PESTS

317. In a small field trial, aldrin at 0.1 per cent. actual (Aldrex 2 at 1:200) was effective against the weevil *Cylas formicarius* F. There were only 4.5 per cent. of badly damaged tubers from the sprayed plots compared with 36 per cent. from the controls.

9.—VEGETABLES

(i) INSECT PESTS

318. Replicated insecticidal tests at Cameron Highlands indicate that 25 per cent. DDT miscible at 0.16 per cent. actual (1:160) gave good control of *Plutella maculipennis* Curt. on cabbages but that 5 per cent. DDT dust was ineffective.

319. Against the flea beetle *Phyllotreta sinuata* Steph. on spinach mustard, two sprayings with dieldrin emulsion was found to give slightly better control than a BHC concentrate.

(ii) DISEASES

320. In a spraying experiment at Cameron Highlands, the effectiveness of five fungicides against Late Blight (*Phytophthora infestans*) of tomato was tested. Attack was heavy in all treatments but Bordeaux mixture again showed its superiority, as judged by yield of fruit produced. Other fungicides used were Shell Copper Fungicide, Fungex, Dithane and Fernide.

10.—CLOVES

321. *Cryptosporella eugeniae*, the cause of a serious die-back of cloves in Penang, has also been discovered on cloves in the Telok Datoh district of Selangor, in Johore and in Malacca. The same fungus has also commonly been found on *jambu* trees (*Eugenia* spp.). The wide distribution of this fungus confirms the view that it is not a recent arrival in Malaya. *Valsa eugeniae*, the cause of sudden death of cloves, has not been observed outside Penang.

11.—FRUITS

(A) Banana

(i) SELECTION

322. The collection at the Federal Experiment Station, Serdang, has been maintained and fruit characters of 85 bunches from the collection have been recorded during the year.

(ii) DISEASES

323. Damage due to the leaf-spotting fungi *Cordana musae* and *Cercospora musae* (*Mycosphaerella musicola*) was prevalent during the last half of the year but has been practically eliminated by fungicidal spraying. Both *Cordana musae* (leaf blotch) and *Cercospora musae* (leaf spot) were found attacking 24 varieties. In addition, *Cordana musae* alone was found on 20 varieties and *Cercospora musae* on 14. Apparent varietal resistance to these fungi was estimated and recorded.

324. An unusual leaf base decay occurred in Perak. This closely resembled a disease described from Australia in which the cause of the trouble was found to be lack of nutrients.

(B) Durian

325. A stem rot of durian was first reported in 1954. Recent work has shown that a species of *Fusarium* is consistently present in the advancing edge of the lesions and it seems likely that this fungus is the cause of the disease. It has been identified as *Fusarium decemcellulare*, the imperfect stage of *Calonectria rigidiuscula*. Two other fungi, *Nectria ochroleuca* and *Nectria haematococca*, have also been found on diseased parts but are probably secondary.

(C) Citrus

326. Analyses of Malayan oranges, lemons and grapefruit have been carried out.

(D) Others

327. Mangosteens and rambutans have been prepared and put down to freezing trials which are still in progress.

328. Among many reports of insect pests submitted, the following were important: In mango stems, the weevil *Cryptorhynchus gravis* F., and in fruits, the long-horned borer *Rhytidodera simulans* White; both were reported from Perak.

329. Two interesting new records from rambutan were the clearwing twig borer *Paranthrene* sp. from Serdang and larvae of the Lymantriid *Porthesia scintillans* Walk. damaging flowers at Kuala Trengganu.

12.—PASTURE AND FODDER

330. Manurial treatments were modified in the grass under shade experiment, and monthly analyses of samples were taken throughout the year from all plots. Results confirmed those of 1954, but showed no significant increase in N content from the extra sulphate of ammonia supplied. This work is now terminated.

331. Samples of the following have been analysed for feeding value:

- Pennisetum purpureum* (Napier grass)
- Panicum maximum* (Guinea grass)
- Centrosena pubescens*
- Imperata arundinacea* (alang)
- Panicum trichocladum*.

13.—MISCELLANEOUS PESTS

332. Frequent reports are received of damage to rafters of outbuildings by the carpenter bee *Xylocopa latipes* (Drury). Good results were reported from Perak when the recommended spraying of Dieldrex 15 at 1:200 was carried out.

333. Larvae of the Pyralid *Terastia meticolosalis* Guen. boring in *dedap* (*Erythrina* spp.), were controlled by endrin (an isomer of dieldrin) at 0.1 per cent. actual after a failure with dieldrin at 0.5 per cent. actual.

334. At 0.05 per cent. actual, endrin was also successful against the flattid bug *Lawana conspersa* Walk. on trunks and branches of *Casuarina equisetifolia*, where it had not been killed by a nicotine sulphate spray.

335. Soil impregnated with dieldrin applied as an emulsifiable concentrate at various strengths and kept indoors in boxes was found after one year to be toxic to workers of *Macrotermes gilvus* Hag. at as low as 0.012 per cent. actual (Dieldrex 15 at 1:1250).

336. Lengths of polythene-covered telephone cables supplied for tests by the Telecommunications Department have been found to be somewhat less prone to attack by *Macrotermes gilvus* Hag. if lead naphthenate (0.5 per cent.) has been used for impregnation of the casing. The orange and white coloured casings of the wires inside the cable were more heavily attacked than the grey and brown casings. Cables sheathed with polyvinylchloride (PVC) were not attacked except where the casing had previously been removed, when the interior tape was slightly scraped.

337. Small blocks of tanalised *meranti* timber (*Shorea*) were found to remain free (except for superficial scraping) from attacks by *Macrotermes gilvus* Hag. for a period of 1½ years. Untreated controls were badly damaged. Larger slabs of a proprietary building material also remained free from attacks for 18 months though *meranti* controls were extensively injured.

338. Two acaricides, Chlorocide at 0.02 per cent. actual and Aramite 15 at 0.3 per cent., were found to be effective and are likely to replace colloidal sulphur as general sprays.

14.—PLANT SAMPLING AND ANALYSIS

339. Analyses have been made of fish meals and stickwater concentrates, samples of rolled oats and chick mash, copra cake and oil.

340. Samples of jute, *ijok* (palm fibre) and Mauritius hemp have been received for reference and examination, and bleaching agents for loofah have been tested. Samples of ipecacuanha and derris roots have been analysed for active ingredients.

341. The following miscellaneous analyses were carried out: edible oils residue, 233; fish meal, etc., 11; agricultural chemicals, 3; arsenic determinations, 7; and waters, tar oil, *Orthosiphon stamineus*, *Cajanus indicus*, *Coleus amboinicus* and jelutong, one each.

15.—SOIL INVESTIGATIONS

(i) SOIL SAMPLE ANALYSES AND LABORATORY INVESTIGATIONS

342. During the year, 4,600 soil samples were examined and a total of 22,700 analyses carried out. In addition, 700 samples of padi leaves and oil palm fronds were received and 4,000 analyses carried out on them.

343. The work of the Soils Division has been largely orientated in two major directions—soil distribution, morphology and genesis, and plant nutrition. The former is closely concerned with soil survey work, which has involved not only the mapping of the distribution of the various soil series but also the study of the mode of origin of these soils by examination of the soil profiles. These factors will be elaborated on below, where it is shown that profile examinations have given information on the nature and origin of the various alluvial soils in Kedah and on the different series of soils derived from the granite on the East Coast.

344. Most of the analytical work was closely connected with the soil survey work, and the programme has been to examine and determine the chemical characteristics of the soils from the different soils series. This work is of direct practical application, for it can be coupled with soil classification and yield.

345. As regards plant nutrition, work has been largely concentrated on analyses of padi leaves from various manurial experiments, particularly NPK factorial experiments, and on leaves from oil palms grown on various soil types. Work has also been carried out on padi in tanks and pots.

(ii) BASE AND ACID EXCHANGE CAPACITY

346. As noted in the report for 1954, exchangeable cations and cation exchange capacity are regarded as important factors in the fertility of padi soils, and a good deal of work was devoted to getting methods of at least a semi-routine nature for these determinations. It has now been decided that leaching with barium chloride buffered with triethanolamine is the most satisfactory. Barium, potassium and sodium are estimated by the flame photometer, and calcium and magnesium by the versenate method. Barium chloride does not apparently remove sufficient iron to interfere with the versenate titration.

347. "Easily soluble" potassium has been investigated although, as yet, it cannot be connected with manurial responses. Experiments have been completed which show the effect of time of shaking, soil-solution ratio and successive extractions using 0.5 N acetic acid. Results show that the length of time of shaking makes little difference to the amount of potassium extracted except that a half-hour period is rather short. One and two hours of shaking extract very similar amounts and the present routing procedure of shaking for one hour would appear to be satisfactory. As the soil to solution ratio is increased, less potassium per gram of soil is extracted. The ratio, 10 gm. of soil to 100 ml. of solution, gives good differentiation between soils.

348. Peat soils, whether they have high or low contents of easily soluble potassium, come to equilibrium very quickly and prolonged shaking extracts very little more potassium. The extremely high amounts of potassium which can be extracted from some peat soils are difficult to explain because peat is generally regarded as needing potash for good plant growth.

349. Successive extractions of the same soil with aliquots of acetic acid give steadily decreasing amounts of potassium, except for upland soils where there is very low initial level of the element. In the case of the latter soils, successive extractions up to the fourth remove about the same amount of potassium. When water instead of acetic acid is used, it is found that it will extract about half the amount extracted by acetic acid.

350. The exchangeable acidity in padi soils is a measurement which has been suggested by Japanese work. The exchange acidity of a wet soil corresponds approximately to the amount of ferrous iron extracted from the soil by exchange reaction. Values are low for oxidised layers and high for reduced layers. A number of samples from the soils survey in Kedah were examined and the values varied from 50 to almost nil. Insufficient numbers have been examined, but the method appears promising as a means of characterising the soils of a padi area.

(iii) GELAM SOILS

351. Soil samples were collected from Tanjong Minyak, a *gelam* area near Malacca, for permeability tests by the Department of Drainage and Irrigation. The disturbed soil was found to be very impermeable but it is necessary to determine permeability of the undisturbed soil before an indication of the water movement can be obtained. This permeability is important because on it depends whether leaching the soil to wash out the sulphates would be a successful method of reclaiming the *gelam* soils.

(iv) SOIL SURVEYS

352. Soil surveys are dealt with in two groups, surveys of dryland areas and surveys of established or prospective padi areas. The area covered in 1955 was approximately 300,000 acres, of which 150,000 acres is still in jungle and represents about 1.5 per cent. of the estimated potential agricultural land as yet undeveloped.

353. (a) *Dryland Surveys*—(i) *Trengganu*.—The reconnaissance soils survey of certain areas of promising agricultural land in Trengganu, which was commenced on a small scale in 1954, was considerably extended during the year. At the same time, quicker and more reliable methods of soil surveying in dense jungle are being steadily evolved. The technique as at present practised depends mainly on visual examination of the soil along traces cut at varying intervals, dependent on the complexity of the soil pattern and the degree of detail required in the final map. A tube sampling method of soil examination was tried with success. Under this system, small auger samples are taken at 100 feet intervals along the trace by the leader of the trace-cutting team and stored in glass sample tubes. These samples are later classified by the surveyor at the base camp and in some cases it

was found that traversing of all the traces by the surveyor was not necessary. In this way the number of trace-cutting teams under the control of one surveyor can be increased. There are of course very obvious disadvantages to this method and it is at present being used with caution.

354. Some 140,000 acres of land, of which about half is likely to prove suitable for cacao, has been examined since the commencement of the survey. The most promising areas for cacao development are concentrated in three places, firstly, the Jerangau Road area between the Kuala Trengganu-Kuala Brang Road and the Sungei* Dungun, secondly, the Ulu Chalok-Sungei Nerus area, through the northern and eastern part of which runs the Kota Bharu-Kuala Trengganu Road, and thirdly, the Sungei Tebak-Bukit Bundi area which lies north and south of the western end of the Ayer Puteh Road in south Trengganu. Soil maps of these three areas are being prepared. During the survey this year, about 220 miles of trace has been cut and 11,000 auger borings examined.

355. In addition to the reconnaissance mapping of large areas, several detailed soil surveys have been carried out in which the complex pattern of soil series and textural types has been plotted. In these surveys the soil has been examined in traces four chains apart and a map prepared on a scale of 16 chains to 1 in. The Federal Experiment Station at the 31st mile Jerangau Road has been examined in this manner and a survey report, with map, has been prepared for publication. Altogether, 3,200 acres has been surveyed in detail.

356. Soil monoliths (actual columns of soil taken from pits and prepared to show the structure of the separate horizons of the profile) have been collected wherever possible and a representative selection of suitable cacao soils is being built up for reference and display. It has been found that the original colour of the soils can be preserved if the monolith is covered with a sheet of plate glass and the column of soil lightly sprayed with water at fortnightly intervals.

357. (ii) *Pahang*.—(a) *Maran Road*.—During the year some field work was carried out in the Maran Road area. A proposed site for a cacao scheme for smallholders was examined in detail and preparations made for a reconnaissance survey of part of the area of very good andesite-derived soil to the north of Kampong Awah.

358. (b) *Sungei Bilut*.—A ten day reconnaissance trip was made in the Sungei Bilut valley near Bentong but no areas of rich soil suitable for cacao were located.

359. (c) *Bukit Goh Forest Reserve*.—Short surveys were made over part of the rich soil suitable for cacao in the Bukit Goh Forest Reserve near Kuantan.

360. (iii) *Kelantan Deficiency Area*.—This is an area situated to the south and west of Pasir Mas. The origin of the term “deficiency area” is obscure but it probably arose because cattle grazing in parts of certain of the districts in that area eventually

* Sungei=River.

showed signs of a bone disease called *penyakit pari* which involves a swelling of the joints and brittleness of the bones. The total area involved amount to about 60,000 acres.

361. After a preliminary visit in 1954, a soil survey of the area was started in April, 1955. From aerial photographs of the area, a vegetation map has been drawn and, apart from cultivated crops such as rubber, rice and small patches of pineapple, there appear to be the following three definite and distinct forms of vegetation:

- (i) open savanna type of country with numerous anthills out of which trees such as *halban* (*Vitex* sp.) are very often growing. The grass is mostly *rumpup jenaris*;
- (ii) secondary jungle growth containing *kedudok* (*Melastoma* sp.), *kemunting* (*Rhodomyrtus* sp.), *tembusu* (*Fagraea* sp.) and various larger trees. This type of vegetation appears to grow better on the drier and sandier parts; and
- (iii) *gelam* (*Melaleuca leucadendron*) occurs in some of the swampy areas, in some places as pure stands and in other places mixed.

Ten soil series have been identified and, of these, four are believed to constitute the deficiency group.

362. It has been noted that agricultural development and soil type are quite closely linked, e.g. rubber planting is mainly confined to Malacca Series soil in the hilly regions and to the sandy Lati Series in the plain adjacent to the river. The area includes a wide textural range of soils varying from very coarse sands to rather heavy silty clays. The general impression is that the soils are highly leached and have very low available nutrient values, possess a poor physical structure and, judging by their profiles, the normal soil forming factors have been at work for a considerable time and the soils may be post-mature or even senile. About 80 soil pits were examined in the area but the analytical details are not yet available. From the survey it will be possible to map the poor soils and distinguish them from the completely impoverished ones and so give an indication of the area which is worth considering for agricultural development.

363. (b) *Padi Land*.—(i) *Kedah*.—In Kedah, yields of padi vary from less than 1,000 lb. per acre to more than 4,000 lb. per acre, the higher yielding areas being found generally within four to five miles of the coast. In the dry season of the past year, a soil survey was started to find the reason for this variation in yields and to classify the alluvial soils of this area on a soil series basis.

364. In starting the survey, a preliminary classification of the soils into 18 series was carried out by examination of some 80 pits dug at intervals along lines approximately five miles apart. The method of classification and profile description was that recommended in the United States Soil Survey Manual. For the preliminary mapping, pits were dug at 1,000 yd. intervals in lines one mile apart. Approximately 500 pits were

dug to cover an area of 150,000 acres. Each pit was sampled to a depth of 5 ft. Detailed surveying of the soil boundaries was started and an 18 in. diameter tractor-mounted auger was used for this. A hole, 3 ft. deep, could be dug in two to three minutes and a little clearing of the side enabled the series to be easily identified. Aerial photographs, 2½ in. to 1 mile, were used for mapping the boundaries.

365. The major factor influencing the formation of these alluvial soils is the parent material, and six associations were identified. These were:

- (i) marine soils. These are laid down as alluvium under marine conditions;
- (ii) river levee soils. These are found surrounding the drainage systems of the Kedah and Perlis rivers and are characterised by well developed structure and red mottling;
- (iii) inland basin soils. These are laid down in low-lying "spillways" in the general surface of the older alluvium during seasonal floods;
- (iv) creek soils. These are elongated, multibranched deposits near the sea in old drainage channels which have gradually silted up;
- (v) Yen complex. A group of soils which owe their nature directly to the influence of Kedah Peak; and
- (vi) inland colluvial soils. Indurated sandy soils which are generally rather low yielding.

366. The importance of this survey lies in the fact that, apart from its practical application for manurial programmes, it is the first attempt to make a systematic study of the morphology of Malayan alluvial soils, and it has been found that there is quite a close connection between the nature of the soils and their chemical analyses. Until this survey was started, it was not realised that there was such a great variation in the soils of the Kedah Plain. Results so far indicate that the very young soils at the coast have not yet been leached of soluble salts and the exchange complex is saturated; as the soils get older, i.e. proceeding inland, they are more unsaturated, especially in the top horizons. The Na/Mg ratio also decreases as the soils become older. These are factors which appear to contribute to the yield potential of the soils. Crop cutting tests are being carried out at each of the points where pits were dug.

367. (ii) *Kuala Langat, Selangor*.—The soil survey of the Kuala Langat (North) Forest Reserve has been completed. Some 1,400 samples from an area of about 50,000 acres were analysed and peat depths at 600 ft. intervals along lines 1,000 yd. apart were recorded. The area is mostly deep peat (7 to 10 ft. depth) overlying fairly heavy clay. The complete survey has confirmed the findings reported in 1954 that much of the peat generally contains little ash and has over 90 per cent. loss on ignition.

368. (iii) *Trans-Perak*.—The soil survey report on this area was completed. As the soil maps indicated that, in the south-east of the area already mapped, there might be considerable

areas of good soil without a peat covering, a further survey was undertaken. This has not yet been completed.

369. An important feature of these soil surveys of the large potential padi areas is the discovery of deep peat often covering very considerable areas. Since peat has not, in the past, shown itself capable of growing even fair crops of padi, its presence in these otherwise suitable areas constitutes a major problem.

370. (iv) *Changkat Jong, Perak*.—The proposed extension (Stage II) of the Irrigation Scheme, amounting to 1,140 acres, was inspected and soil sampled. Provisional recommendation was made that the proposed extension be undertaken.

371. (v) *Paya Berhala Kayu, Besut, Trengganu*.—The soils of this area were inspected to assess their suitability for padi. The soils were found to consist of shallow acid peat and muck and a white mixture of kaolinitic clay and sand of widely varying texture. Development of the area for padi was not recommended.

16.—PLANT NUTRITION STUDIES

372. The two major projects under way were (i) sampling and analyses of padi plants from factorial manurial experiments and (ii) analyses of oil palm fronds from a number of estates.

373. (a) *Padi*.—Samples were obtained from three 3³ NPK factorial experiments, two in Kedah on coastal clay and one at Segu in Pahang on granite-wash soil. Treatments were in duplicate, so that there were 54 plots in each experiment. Plants were sampled eight weeks after transplanting and whole plants, cut off at 6 in. above ground level, were used. Twelve plants were taken from each plot for bulking and sub-sampling. The plants were analysed for N, P, K, Ca and Mg. The results can be summarised as follows:

(i) calcium and magnesium uptake of the plants was unaffected by any of the treatments but the uptake varied markedly from place to place. The average MgO content (on ash basis) for Segu was 1.13 per cent., for Hutan Kampong, Kedah, 2.71 per cent., and for Sala Kanan, Kedah, 3.05 per cent., while the average CaO content for Segu was 2.59 per cent., for Hutan Kampong 4.68 per cent. and for Sala Kanan 3.20 per cent.;

(ii) potassium uptake was not influenced by potash manuring at Sala Kanan and Hutan Kampong in Kedah, but manuring had a significant effect on the uptake of potassium at Segu in Pahang. There was no yield increase, however. The strange fact about this result was that the control at Segu already contained about 50 per cent. more K₂O than the control at Hutan Kampong, where the manuring did not increase potassium uptake. Thus it appears that the high CaO in Hutan Kampong plants decreased the uptake of potassium;

- (iii) phosphorus uptake was increased significantly at Hutan Kampong by phosphorus manuring but there was no increase in yield. At Sala Kanan also, phosphorus manuring significantly increased phosphorus uptake without increasing the yield. The most marked increase in phosphorus uptake was at Sega where the P_2O_5 content of the ash increased from 2.33 per cent. in the control to 4.44 per cent. at the P_2 level. Once again there was no improvement in yield. These results indicate either that the phosphorus manuring led to luxury consumption of phosphorus without any influence on yield or that some other factors were limiting. It is possible that magnesium is the limiting factor at Sega; and
- (iv) nitrogen at Hutan Kampong did not increase yield but significantly increased nitrogen uptake. At Sala Kanan, nitrogen increased yield and significantly increased nitrogen uptake. At Sega, nitrogen slightly increased magnesium content and significantly decreased phosphorus uptake.

374. (b) *Oil Palm*.—There are indications that frond analyses are much more suitable for manurial advisory purposes than soil analyses, but the difficulty is to establish threshold values for different ages of palms and for different soil types. With this in view, six selected estates in Selangor which were known to cover most of the soil types on which oil palms are grown were asked to co-operate by allowing sampling to be carried out and by supplying records of yields and manuring during the past four years. Representative fields were selected on each estate and these were roughly divided into 10-acre blocks. From each block a bulked sample taken from 10 palms selected at random was obtained. The soil types included peat, coastal clay, laterite and other inland soils derived from quartzites and shales. Samples of fronds 3 and 17 and, in one estate, fronds 3, 9, 17 and 25 have been sampled to study nutrient gradients. So far, 506 samples have been taken and ash, N, P, K, Ca and Mg determined.

375. Examination of the results is by no means complete but some interesting facts have emerged. Nitrogen is very constant regardless of soil type or age of the palm; also there is very little difference between fronds 3 and 17. The ash in the fronds of palms grown on peat is considerably lower than in those grown on mineral soils. The ratio Frond 3/Frond 17 K_2O increases with the age of the palms.

17.—NEW RECORDS OF PESTS AND DISEASES

376. Among the many diseases observed or investigated during the year, the following, which had not previously been recorded, may be noted:

Storage rot of sweet potato—*Ceratocystis* sp.;

leaf spot of *Tabernaemontana coronaria*—*Cercospora tabernaemontanae*;

leaf spot of *Cassia fistula*—*Cercospora angustata*;

leaf disease of tomato—*Diplodina lycopersici*;
 basal stem rot of lime (*Citrus aurantifolia*)—*Nectria haematococca*; and
 storage rot of Gladiolus corms—*Fusarium* sp.

In addition, the following new host records were made:
 basal leaf rot and wilt of tuberose (*Polianthes tuberosa*)—*Sclerotium rolfsii*;
 white threadblight of rambutan and *Flemingia congesta*;
 white root disease of limau kasturi (*Citrus microcarpa*)—*Fomes lignosus*;
 pink disease of calabash (*Crescentia cujete*)—*Corticium salmonicolor*; and
 leaf rot of *Panicum trichocladum*—*Corticium (Rhizoctonia) solani*.

377. The following new insect pests were recorded:

Cacao.	Aegeriid	<i>Conopia</i> sp. on trunks and in pods, and
	Cossid	<i>Zeuzera roricyanea</i> Walk. in branches;
Tea.	Acarina	<i>Acaphylla steinwedeni</i> Keifer, and <i>Brevipalpus</i> sp. nr. <i>phoenicis</i> or <i>inornatus</i> ;
Rose.	Acarina	<i>Eotetranychus smithi</i> Pritchard and Baker; and <i>Cheletogenes ornatus</i> (Can. and Franz.);
<i>Hibiscus mutabilis</i> }	Acarina	<i>Aceria hibisci</i> (Nalepa); and
<i>Hibiscus sinensis</i> }	Acarina	<i>Brevipalpus australis</i> (Tucker).

18.—INTERNATIONAL RICE COMMISSION

378. The fifth meeting of the Working Party on Fertilisers and the sixth meeting of the Working Party on Rice Breeding were held in Penang from December 5th to 11th and were attended by delegations from eighteen nations and international organisations. The United Kingdom (Malaya) delegation included the Acting Senior Chemist (Soils), the Senior Botanist and the Chief Research Officer, who served as Chairman to the Working Party on Rice Breeding. Ten other members of the Research Branch attended as advisers and observers.

B.—AGRONOMIC AND LIVESTOCK INVESTIGATIONS

1.—CROPS

(A).—Padi

(i) WET PADI

(a) Mechanisation

379. Harvesting trials were carried out in four States and Settlements. The Massey-Harris No. 80 Self-Propelled Rice Special Combine had a disappointing season because of major mechanical failures coupled with the lack of a local spares service.

380. The new semi-mounted Rajah thresher, a development of the Rayat prototype, was received late in January and brief trials gave promising results.

381. The Opperman baler was used successfully in Kedah and Kelantan, the padi straw being collected by a tractor-mounted buckrake.

382. The Bisset semi-mounted binder has proved to be a manœuvrable machine although early tests were confined to dry padi areas on flat land in Pahang.

383. Work has commenced on the study and improvement of local ploughs and other animal-drawn implements and nine types of plough have been imported from India and Japan. Some of the Japanese implements have shown promise, although they are somewhat heavier than the Malacca plough.

384. Work has started on opening up a mechanised farm in the Trans-Perak Irrigation Area, near Parit, and 70 acres had been cleared of forest by the end of the year with the timbers windrowed in readiness for burning. The aim here is to obtain complete water control in order to permit the use of standard, medium sized, wheeled tractors and their associated implements. If the farm is an economic success it will indicate the optimum size of a holding for a one-family mechanised unit and determine whether such a unit can produce padi more or less economically than by traditional methods of small lots.

(b) Agronomy

385. In the crop harvested early in the year, satisfactory responses to fertiliser dressings were recorded from areas representative of about 60 per cent. of Malaya's padi land. Yields varied from place to place but it was of considerable interest to record a response in yield from manuring of over 100 gantangs (gallons) per acre at Pulai Padi Test Station, Kedah, where the average yield was 830 gantangs per acre.

386. Investigations have commenced on the effect of growing green manures in the off-season, both in the presence and absence of fertiliser. Germinated seed of *Sesbania aculeata* was used and good growth resulted at one locality, fair growth at another and failures at the other three Stations.

387. Yields of up to 1,800 lb. of grain per acre were obtained from crops grown on deep peat soil at Padang Kemunting, Trengganu, with the help of surface burning of the peat followed by applications of phosphate. This is the second season in which fair crops have been grown by such methods. The results are important since attempts elsewhere in the past to grow wet padi on deep peat have always failed.

388. There is as yet no evidence to show that minor elements are of benefit to padi growing on peat.

389. Nine years' agronomic research on double cropping of padi at Bukit Merah, Province Wellesley Central, has recently been summarized and it has been concluded that double cropping

is a sound system of agriculture in Malaya, wherever water supply is adequate, provided that fields are manured regularly and that short term varieties are grown in both seasons. It has been shown conclusively that this practice does not reduce the yield from the double-cropped area in the main season, so the off-season yield represents a real gain. Nevertheless, there are practical difficulties to the extension of this system since the time available for maintenance of irrigation works is reduced.

390. In the 1955-56 season, 84 replicated trials were laid down on Experiment and Test Stations and some 765 simple trials of three to six plots each were put down on cultivators' fields. These last included 565 separate replicates of a three-plot experiment designed to compare 50 lb. per acre of P_2O_5 as Christmas Island rock phosphate with 30 lb. per acre as double superphosphate in the presence of nitrogen and potash, the third treatment being control. These comparisons are of practical importance because of the price differential in favour of the water-insoluble phosphate. More precise comparisons are in progress in the replicated experiments.

391. Nursery manuring continues to receive attention because it is often the cheapest means of increasing yield by the use of fertilisers. During the off-season, simple trials on 10 smallholdings in Province Wellesley gave the following mean yields of grain:

Nurseries manured	...	...	1,168 lb. per acre
Not manured	...	...	946 lb. per acre
Difference	...	...	222 lb. per acre

Yields are low because of local water shortage, but the increment was worth about \$21 whereas the fertiliser used cost only about \$2 per planted acre.

392. The variety Engkatek has been found to be of considerable agronomic importance as it has short, stiff straw and its resistance to lodging has not broken down under heavy manuring. It should prove ideal for mechanised cultivation.

393. The fifth meeting of the International Rice Commission Working Party on Fertilisers was held in Penang in December contemporaneously with the sixth meeting of the Working Party on Rice Breeding; some items were discussed in joint session. This meeting was convened by the Food and Agriculture Organisation of the United Nations and the former Working Party was attended by 26 participants representing 12 governments. Five special papers on agronomic subjects were prepared and a sixth paper was also written for a co-ordinated study of the interaction of fertiliser response with varieties.

(ii) DRY PADI

394. Factorial 3^3 NPK fertiliser experiments are in progress at Melor, in Kelantan, and at Paya Besar, Pahang. Mean yields were low at both places but significant responses were demonstrated from water soluble phosphate at both localities and from nitrogen at Melor. Nitrogen appeared to depress yields at Paya Besar, particularly in the absence of potash. At Melor, there was a

highly significant effect from all three nutrients on yield of straw. With this crop the pattern of yield response is very dependent on distribution of rainfall.

395. The very poor soil at Kampong Pusu, Kelantan, will grow only poor crops of dry padi which show a marked response in yield from phosphate but not always from nitrogen and potash. In the 1955-56 season, an NPK lime factorial experiment was converted into a 2⁵ design with 5 tons per acre of cattle manure supplying the fifth factor. It is reported that this small application has had an outstanding effect on the growth of the crop.

(B).—Oil Palm

396. Two co-operative factorial manurial experiments are in progress on estates situated on different types of alluvial soils but no results of interests have yet emerged.

397. In a replanting and manuring trial at the Federal Experiment Station, Serdang, extensive leaf yellowing appeared early in the year and all palms, which were then 4½ years old, were each given an application of 6 lb. of Kieserite, i.e., commercial magnesium sulphate. There has since been a most marked improvement in appearance and fronds are now a healthy green colour. In this trial, young palms which were planted three years before felling the old stand still remain stunted and backward.

(C).—Coconut

398. The first 45 acres of a new Federal Experiment Station for coconut research was cleared during the second half of the year. It is situated at Teluk Bharu, south Perak, adjacent to some 100,000 acres of coconut estates and smallholdings, the soil being a rich deltaic alluvium.

399. All main and field drains were excavated by machine and the quality of the work was excellent but it was completed too late for any planting to be carried out. On this particular soil type it is essential to give the soil plenty of time to weather before filling in planting holes.

400. Coconuts are grown on the strip of coastal sand and on the raised beaches along the East Coast. In a representative area at Batu Rakit, Trengganu, a simple manurial trial has been laid down. Manurial treatments are being applied at six-monthly intervals; the first dressing was applied in August, 1954. Yields of nuts per acre for the two periods September, 1953, to July, 1954 (pre-treatment year) and September, 1954, to June, 1955 (first post-treatment year) are given below:

Annual Application per Palm	Yields of Nuts per Acre	
	Sept., 1953-July, 1954	Sept., 1954-June, 1955
A—14 lb. NPK ...	990	627
B— 7 lb. NPK ...	866	521
C—No fertiliser ...	1,131	518

401. While it is impossible at this early stage to draw sound conclusions about treatment effects, the drop in all yields during the first year of the experiment proper cannot be ignored.

402. This fall in yield is accounted for by the abnormal weather during November and December, 1954, a very severe

infestation of squirrels in the area of the trial and root pruning caused when changkolling the manurial mixture into the soil round the base of each palm.

403. Yields in this area are very low, partly because of squirrel damage and partly because of the very sandy soil.

404. It is very noticeable that where old coconuts are being replaced with oil palms the latter are very much more tolerant of acid soils than are coconuts. This means that third-rate coconuts can often be replaced by first-class oil palms.

(D).—*Pineapple*

405. An Agronomist has been resident throughout the year at the Federal Experiment Station, Jalan Kebun, Selangor, and he has also paid periodical visits to the other Federal Experiment Station on deep peat soil at Alor Bukit, south Johore.

406. Early yields from fertiliser trials at Jalan Kebun suggest that fertilisers are unlikely to be required for the first two years after clean clearing and burning provided that slips have been dipped in Bordeaux mixture.

407. Potash is naturally the first nutrient to become deficient and relatively large quantities are necessary. For the variety Singapore Spanish the optimum applications of potash would seem to be 100 to 150 lb. per acre per year. This has to be balanced with nitrogen, particularly on old land.

408. With pineapples on peat, phosphate is not, apparently, an important nutrient and a definite requirement has not yet been proven.

409. Experiments with fruiting control and with time and method of decrowning continue with both the main varieties. With Singapore Spanish the first harvest gave the following percentage fruiting:

Treated with alpha-naphthalene acetic acid ...	84.5 per cent.
Treated with carbide water	78.4 per cent.
Control—untreated	38.5 per cent.

The amount of broken core was greater with carbide water than where "A.N.A." was used.

410. With Sarawak pines, fruiting control is less effective. In a trial at Jalan Kebun the treatments were given, in two applications, in September, 1954, when the crop was 17 months old. By early April, 1955, only 16 per cent. of the plants had fruited and there was then little crop until June-July, at the end of which period 44 per cent. of the plants had fruited. Treatment effects are summarized below:

Treatment	Percentage Fruiting	
	Up to 3-4-55	Up to end of July, 1955
Carbide water ...	33.0	53.1
A.N.A. solution ...	13.3	47.3
Control ...	3.6	48.4

It will be noted that only carbide water is effective with the Sarawak variety.

411. In ridging and spacing trials it has become evident that ridging a single row of plants becomes unsatisfactory because of root-exposure and the tendency of such plants to fall over when bearing fruit. A flat-topped bed bearing a double row of plants is more efficient as the close-spaced plants give each other mutual support. However, the benefit of ridging is only evident in the first crop, and it is probably an uneconomic practice.

412. In general, the closer the spacing the higher is the yield of fruit from the first crop and the smaller is the fruit size. This decrease in size is more beneficial with Sarawak than with Singapore Spanish so a closer initial spacing is recommended for the former variety. Departmental recommended spacings are now as follows:

Singapore Spanish	...	2 rows 2 × 2 ft. with 4 to 5 ft. lanes.
Sarawak	...	2 rows 2 × 1 ft. with 4 ft. lanes.

413. After carrying out several preliminary trials, an experiment has now been laid down to compare 25 lb., 50 lb. and 75 lb. per acre of a soluble NPK fertiliser applied as a nutrient spray with 150 lb. per acre applied by traditional methods to the soil. All dressings are annual ones. Although the fertilisers used are different their NPK content is approximately equivalent.

414. At Jalan Kebun, some 19 acres has been planted in double-rows, 2 × 2 ft. with 5 ft. lanes, with every ninth double-row omitted to facilitate mechanised trials. The 12 ft. paths at one chain apart give access for transport of fruit and for spraying and other field operations.

415. Early intercultivation with mechanical equipment tends to cause differential consolidation of the peat and the rows are left up on ridges. This aspect justifies a cautious approach to full-scale mechanisation, especially when hand weeding remains so cheap.

416. A prototype boom sprayer mounted on a Ferguson tractor has shown some promise but is too heavy. It will have to be re-designed and constructed with lighter materials. Similarly, the first tank to be tested was too heavy for use on peat soils.

417. The herbicide C.M.U. is being tested in Kuala Lumpur and at Jalan Kebun. It has given good weed control in drains for three months with a dosage of 3 to 6 lb. per acre; at 10 lb. per acre there was still some control after six months. On flat mineral soil, C.M.U. has given promising weed control in Kuala Lumpur at low dosages but on peat it has been unsuccessful as it appears not to control the common "watergrass", *Commelina nudiflora*.

418. Sodium pentachlorophenate has given good results at 20 lb. per acre in drains and inter-rows for three to four months. This substance should be used with caution in the tropics as it is poisonous. The use of these herbicides is not at present an economic proposition.

(E).—Cacao

419. The NPK factorial experiment which was planted with Trinitario cacao at Jerangau Estate in September, 1951, has

continued to demonstrate the paramount importance of phosphorus in the early stages of growth. It is somewhat natural, therefore, that yield figures for 1955 have also shown a marked response to this nutrient. Since it is not really possible to study the nutrient requirements of mature cacao in this experiment—so great are the differences in early growth—arrangements have been made to remedy this deficiency and a large experiment with a 2ⁿ design was planted with Amelonado in April at the Federal Experiment Station, Jerangau. The whole of this trial will receive uniform treatment until at least mid-1958.

420. Arrangements have been made to lay down a similar experiment at Kampong Awah in Pahang on andesitic soil.

421. Another small but important manurial experiment on Amelonado was planted at the Federal Experiment Station, Jerangau, in September, 1954, and girth measurements taken in November, 1955, have shown that a combined dressing of Christmas Island rock phosphate and ground magnesium limestone has led to better growth than single or double dressings of either fertiliser alone.

422. It is already clear from a bare-root seedling experiment that soft treatment gives better results than hard nurseries. The former are standard shaded nurseries on rich soil; the latter are close-spaced, with the minimum of shade and situated on sandy alluvium. Even under the best conditions the transplanting of bare-root seedlings is a speculative operation and the plants receive a considerable check in growth. One other trial has demonstrated that if the roots are dipped in a slurry of rock phosphate and water before planting they derive some benefit, but the method is a tedious one of little practical value.

423. A valuable technique has been evolved for raising seedlings in single-ply veneer tubes 9 in. tall and about 4½ in. across. Since such tubes can be used two or three times they are cheaper than normal baskets and the planting method is a very neat and efficient one.

424. Towards the end of the year an important 17-acre establishment trial was cleared at the Federal Experiment Station, Jerangau, in order to test four different techniques of establishing Amelonado seedling cacao with cultivated shade. Trees on 15 acres have been felled and the land partially burnt, lined and planted with shade trees; cacao will be planted one year later. The balance of two acres was planted with dry padi and maize and cacao was underplanted at a spacing of 6 × 6 ft. The cacao became well established in spite of some early leaf scorch soon after planting out.

425. It has been established that certain forest trees, notably *Shorea leprosula* and *Trema* spp., are unsuitable for use as cacao shade since they suppress the growth of the crop. This discovery has already been of practical value to commercial planters.

426. Considerable use is being made of seedlings of *Indigofera teysmanni* to provide rapid shade for young cacao. These seedlings are normally raised in soil blocks and they grow so

rapidly after planting out that cacao can be planted within six months. This nurse-crop is probably superior to *Gliricidia sepium* as it is faster growing and often more vigorous on upland soils.

427. Trial two-year old plantings of Amelonado cacao under 26-year old tall coconuts on an estate in south Perak have shown excellent growth on free-drained alluvial silty-clay. Even on this soil it is necessary to manure the young plants with phosphate. The cacao has been planted about 12×15 ft. and the palms are spaced 29×29 ft. triangular. Equally promising growth has been noted on the same estate under dwarf coconuts.

428. Underplantings have also been carried out under 40-year old palms on another estate on similar soil in north Selangor. The first trials were with Trinitario cacao and the later ones with Amelonado. Here it has been found necessary to plant some intermediate shade and *Erythrina subumbrans* has been fairly satisfactory.

429. Amelonado cacao planted under old oil palms at Ayer Hitam, Johore, has now been judged a failure in spite of good early growth. This result confirms experience at Serdang where Criollo cacao failed under oil palms in spite of heavy manuring.

430. A simple experiment at Jerangau has tended to confirm the value of using double superphosphate in basket composts in preference to a cheaper double dressing of rock phosphate. Differences were not very great but it always pays to be generous with nursery practice.

431. A new halting bungalow was completed at Jerangau during the second half of the year, thus providing improved facilities for visiting officers. Shortly afterwards, in October, an Agronomist was posted to the Station for full-time duties.

432. A guide to the Federal Experiment Station, Jerangau, has been completed and cyclostyled. This includes a most useful detailed soils map prepared by the Research Branch.

433. The spray propagator at Serdang has been renovated and improved and is now in regular use for the propagation of clonal material for the Botanical Division.

434. Cacao fields at Serdang have been well maintained and pest control has been greatly facilitated by the use, whenever necessary, of a Swingfog for the control of *Helopeltis theobromae* by a D.D.T. fog.

435. A revised leaflet on cacao has now been produced and summarizes the latest information on cultivation of this crop.

436. At the 20th Malayan Agri-Horticultural Association Exhibition held in Kuala Lumpur in August, cacao was given pride of place in the large Departmental exhibit. Growing trees were displayed, together with suitable shade and nurse crop, and every stage of cultivation and processing was demonstrated.

437. The Senior Agronomist attended the Cocoa Conference in London in September and gained considerable benefit from contact with workers from other countries.

(F).—Tea

438. During the year a nitrogen manurial experiment at the Federal Experiment Station, Cameron Highlands, completed its first cycle and has since been pruned. Yields of made tea for this first cycle are summarized below:

MEAN YIELD IN LB. PER ACRE OF MADE TEA AT 22 PER CENT. CONVERSION

		Annual Application of Nitrogen per acre			
		Nil	40 lb.	80 lb.	120 lb.
First year ...	...	444	446	451	474
Second year ...	...	939	970	994	1,032
Third year...	...	634	713	740	824
Half of fourth year		184	254	330	379

439. In this experiment all plots received an annual basal dressing of 30 lb. per acre each of P_2O_5 and K_2O as Christmas Island rock phosphate and muriate of potash respectively. The nitrogen was applied as sulphate of ammonia.

440. The mean yield of made tea from an NPK factorial trial in its second year was 749 lb. per acre. There was a clear response in yield to both N and P and the presence of P enhanced the N effect. The following effects were demonstrated:

Nutrient	Annual Application (lb. per acre)	Increment (lb. per acre)	Standard Error
N ...	80	49.5	± 12.626
P_2O_5 ...	30	35.2	± 12.626
K_2O ...	30	13.4	± 12.626

The increment from phosphate is obtained at a considerably cheaper price than from nitrogen but balanced manuring is necessary.

441. A tea pruning and disease control experiment which was laid down in early 1953 at Cameron Highlands has now completed its second year of the first pruning cycle. Treatments under trial are as follows:

- P_1 —Hard pruning, 12 in. above ground; no rim lungs.
- P_2 —Medium pruning, 16 in. above ground; one rim lung.
- P_3 —Light pruning, 20 in. above ground; two rim lungs.
- P_4 —Hard pruning, first cycle; medium, second cycle; light pruning in the third cycle.

Each plot was split for spraying against Blister Blight disease, during recovery from pruning, versus no spraying.

442. The second year yields, in lb. made tea per acre, are summarized below:

P_1	P_2	P_3	P_4	S.E.
998 ...	1,012 ...	933 ...	1,081 ...	± 40.78

It will be noted that the quick recovery from pruning of the P_3 plots has not led to increased yields.

443. Yields from sprayed and unsprayed plots were virtually identical.

444. The propagation of tea clones at the Federal Experiment Station, Serdang, continues slowly. However, improvements in technique have been effected and use has been made of veneer tubes for propagation purposes.

(G).—*Coffee*

445. Two manurial experiments with Liberian coffee on deep peat soil are in progress at Jalan Kebun, Selangor. The crop is now $2\frac{1}{2}$ years old and removal of flowers was stopped in June, so the first crop can be expected shortly. There is very considerable variation between blocks and some differences within plots in this experiment but it is now clear that potash is required for healthy growth and that burning of the peat before planting is beneficial. Nitrogen appears to be harmful as it suppresses growth of secondaries, particularly in the absence of potash.

446. In the minor elements trial some defoliation resulted when dilute solutions of copper and zinc sulphates were applied but this can be avoided by first neutralizing with slaked lime. When copper is applied as Bordeaux mixtures it appears to be beneficial, as judged by the resulting deep green leaf colour.

447. Mechanical intercultivation of this coffee has led to differential consolidation of the peat so that the bushes are now on mounds and some root exposure has resulted. Some form of furrow planting is perhaps necessary on deep peat.

448. A shade and variety trial on Serdang sandy loam which was planted in January, 1948, gave the following mean yields for 1955:

MEAN YIELD IN LB. OF DRIED BEANS PER ACRE PER ANNUM						
		No Shade		Light Shade		Heavy Shade
Liberian	...	392	...	140	...	139
Uganda	...	142	...	40	...	71

It will be noted that Uganda coffee, a Robusta type, continues to yield very poorly.

449. A small variety trial of two types of Arabica coffee was planted at the Federal Experiment Station, Cameron Highlands, in May, 1952, and subsequent growth has been satisfactory. The first small crop was harvested towards the end of the year.

(H).—*Fibres*

(i) MANILA HEMP

450. The variety trial at Serdang has now been concluded and a half-acre nursery of Tangongon has been planted on rich soil. The trial was on relatively poor soil and the crop had to be manured heavily. The mean annual yield of six varieties over a period of four years was only 267 lb. of fibre per acre, the highest yielder being Tangongon with 618 lb. per acre closely

followed by Serdang C with 518 lb. per acre per annum. The superiority of Tangongon over Serdang C is greater than these figures indicate because handling and factory costs are less owing to the production of fewer but larger stems of high fibre content.

451. Another variety trial is in progress at Sungei Ruan in Pahang where four Temerloh selections are being compared with Tangongon and Bangulanon. During the year the standard variety, Tangongon, yielded 25,200 lb. per acre of harvested stems, this being equivalent to 756 lb. per acre of fibre at a 3 per cent. extraction rate. The next best yielder was Temerloh 45, with less than half this yield.

452. A half-acre block of Tangongon hemp at Degong, on river alluvium, has been giving a fibre yield of about 1,700 lb. per acre per annum without manuring.

(ii) MAURITIUS HEMP

453. Harvesting has commenced in a shade trial at Serdang but yields have been poor and there has been some premature poling, perhaps because of the low fertility of the soil on which the trial is located.

454. Observation plots on sandy soil at Gajah Mati, Kedah, and in Penang have grown well with very little attention.

(iii) OTHER FIBRES

455. Very little attention is being given to other fibre crops apart from maintenance of planting material and the supply of experimental quantities of fibre to research workers in other countries. A number of ramie clones are being maintained at Serdang; seed crops of Segama jute have been grown at Kuala Lumpur; and mass selections of *Phormium tenax*, New Zealand Flax, are grown at the Federal Experiment Station, Cameron Highlands.

(I).—Fruits

(i) BANANA

456. Two manurial trials were concluded during the year because of poor growth and yields—one at Ayer Hitam, Johore, the other at Ampang Tinggi, Negri Sembilan. A third trial is still in progress at Cameron Highlands; here growth has been quite good and harvesting commenced in February.

(ii) RAMBUTAN

457. The Serdang variety trial was in bearing during December and January and individual tree records were kept. The majority of the rogues in this trial have now been identified.

458. A number of rogues have also been finally identified in the variety trial at Degong, Perak, but individual tree records are being kept.

459. Arrangements are being made to replace all doubtful budwood nurseries with marcots.

(iii) DURIAN

460. The variety trial at Serdang gave its first harvest in January with a smaller crop in March and December. The clone

D. 8 has been found to be inferior and has been discarded. Considerable trouble has been experienced from a dieback caused by *Nectria* sp. and trees have shown symptoms of distress during dry weather. It would seem that the soil and site are not ideal for durians.

(iv) CITRUS

461. Land has been cleared at the Federal Experiment Station, Gajah Mati, Kedah, for grapefruit variety and stock-scion trials and the necessary planting material is being raised.

(J).—Fodder Grasses

462. A study has been made of the results of protein analysis carried out by the Chemistry Division of the Research Branch of Guinea grass samples from two agronomic trials. This has revealed that the protein content of Guinea grass can be increased by increasing applications of sulphate of ammonia up to 10 cwt. per acre per year. The yield of protein from the heaviest manured plots was approximately double that from control ones. Varying the frequency of application of a uniform annual manurial dressing did not affect the mean protein content of the grass.

463. The detailed results of this study have been prepared for publication.

464. Five fodder-type strains of Guinea grass imported from East Africa in 1954 have been bulked at the Federal Experiment Station, Kuala Lumpur, and the best show considerable promise and will be tested in variety trials against the local strain.

(K).—Pastures

465. The factorial NPK manurial trial on *Axonopus compressus* under shade of *Enterolobium saman* was amended early in the year whereby the N and K levels were doubled and the P ones halved. Yields are summarized in the table below:

	Yield of Fresh Cut Grass in lb. per acre						Mean
	P ₀	P ₁	P ₂	K ₀	K ₁	K ₂	± 1,408.2878
n ₀	36,264	41,073	39,712	39,640	37,208	40,202	39,016
n ₁	51,038	42,435	42,144	44,958	46,518	44,141	45,206
n ₂	55,249	47,553	48,606	46,646	49,550	55,212	50,469
	± 2,439.2253			± 2,439.2253			
p ₀				49,858	44,123	48,569	47,517
p ₁				40,910	46,718	43,433	43,687
p ₂				40,474	42,435	47,553	43,487
	± 2,439.2253						
Mean	47,517	43,687	43,487	43,748	44,425	46,518	44,897
	± 1,408.2878						

It will be seen that there was a marked linear response to applications of nitrogen up to 8 cwt. per acre sulphate of ammonia (n₂) and this response was reduced by the presence of phosphate applied as 1½ or 3 cwt. per acre of basic slag. The potash effect was not significant although dressings of 2 and 4 cwt. per acre were given. The n₂p₀ yield of 24.66 tons per acre per year is almost comparable with that of fodder grass on poor soils.

466. A serious attempt has been made to devise a method of recording yields of grass as liveweight gain using sheep as experimental animals but this ended in failure since the sheep used proved to be very poor doers. The use of cattle is difficult with plots as small as those in this experiment.

467. In the shade and variety experiment at Serdang the total yields of fresh cut grass for the period 1-3-50 to 28-6-55 were as follows:

Variety	Shade (ton/acre)	No Shade (ton/acre)	Means (ton/acre)
<i>Axonopus affinis</i> ...	64.66 ...	76.37 ...	70.51
<i>A. compressus</i> ...	70.28 ...	67.20 ...	68.74
Means ...	67.47 ...	71.79 ...	69.63

468. Analysis of variance shows that differences between varieties and between shade treatments are non-significant but that the interaction is significant.

469. Lack of grazing has encouraged invasion by lalang, *Imperata cylindrica*, and this species is now dominant in the no-shade plots. Under shade, however, *A. compressus* is now dominant in all plots. Hence weight records do not give a true indication of the value of treatments since the shaded grass is almost certainly more nutritious than the lalang sward. After June 28th, routine monthly experimental cuts were stopped and rotational grazing with Kedah cattle was commenced with the help of electric fencing. The stocking rate was adjusted according to the carrying capacity of each block and the seasonal changes in the growth of the pastures.

470. Planting material of two very promising East African grasses has been imported from Ceylon. The grasses are:

Panicum trichocladum

Brachiaria brizantha

Both species are prostrate with a vigorous spreading habit. The former establishes quicker but the latter appears to be more palatable and is the better weed smotherer. Material has been bulked up in Kuala Lumpur in preparation for large-scale trials in different localities.

471. During the year some 500 seed samples were received from the Commonwealth Scientific and Industrial Research Organisation, Canberra, through the Pan-Malayan Scientific Advisory Council. These are all grasses and legumes and many are potential pasture species. A selection of the most promising is being studied at the Federal Experiment Station, Kuala Lumpur.

(L).—*Tobacco*

472. White Burley tobacco has grown well on peat soil at Jalan Kebun in a long-term rotation experiment. The other crops in the rotation are maize, kangkong and ginger. Although the yield of leaf was quite good, quality was poor as a result of attack by "Frog's Eye Spot" disease caused by the fungus *Cerspora nicotianae*.

473. Work has commenced on improving nursery technique, this being in progress at the Federal Experiment Station, Kuala Lumpur, in collaboration with the Senior Plant Pathologist. Seed-borne diseases are not apparently important in Malaya but protective spraying may be advisable in the nursery.

(M).—*Vegetables and Food Crops*

474. Modified forms of the John Innes seed and potting composts are in regular use at the Federal Experiment Stations, Serdang and Kuala Lumpur. The composts are very similar to those in use in the United Kingdom but it has been necessary to use jungle loam of standard texture, to replace meadow loam, and weathered tropical peat sub-soil, as a substitute for horticultural peat, as these ingredients are not available in Malaya. Investigations to clarify optimum NPK requirements and pH of these composts are in progress but the present product has proved to be very satisfactory.

475. Variety trials with imported cauliflower strains have been conducted at the Federal Experiment Stations, Cameron Highlands and Kuala Lumpur, with each trial repeated once. At Cameron Highlands the best variety was Sutton's Snowball with Snowdrift 16 second. The American Burpeeana did badly although it was once the best variety for the Highlands: presumably the strain has deteriorated. In the lowlands only the two control varieties gave a crop, these being Early Market and Early Patna (Sutton's).

476. The long term vegetable manurial trial has been continued at the Federal Experiment Station, Cameron Highlands. It will be remembered that it was designed to test possible substitutes for prawn dust, the treatments being as follows:

- A. Prawn dust at 5 tons per acre per annum.
- B. "Sterameal Black Label" at 3 tons per acre per annum plus inorganics.
- C. Groundnut and soyabean cakes at 3 tons per acre per annum plus inorganics.

Three crops are planted each year, these being cabbage, beet or lobak and French beans. Results to-date are summarized in the Table below:

YIELD OF FRESH MARKETABLE VEGETABLES
(lb. per acre)

Cycle	Crop	A	B	C	S.E.
I	{ Cabbage ...	32,229	29,368	38,336	± 897.37
	{ Beet ...	8,294	9,088	16,020	± 924.2
	{ French beans ...	11,870	15,130	12,990	± 643.98
II	{ Cabbage ...	5,432	9,062	16,990	± 701.57
	{ Lobak ...	33,500	29,400	31,500	± 1,852.02
	{ French beans ...	15,360	11,130	5,610*	± 872.56
III	{ Cabbage ...	26,822	20,986	37,762	± 1,483.44
	{ Lobak ...	38,392	36,930	42,174	± 1,290.88
	{ French beans ...	12,970	18,389	13,612	± 577.06

* The low yield was associated with a disease which was suspected to be caused by a virus and might, therefore, have been transmitted by the bean cake.

477. It will be seen that Mixture C was best for cabbages and beet and as good as A for lobak; for French beans B was best in two years and A in one. In 1952, when the trial was planned, the various mixtures cost as follows:

A	\$2,281	per acre per annum
B	\$1,166	„ „
C	\$1,323	„ „

478. It may be concluded that prawn dust is an expensive fertiliser for vegetables because of its moisture content and it is usually inferior to bean cake or Sterameal with added inorganic fertilisers. The logical combination of compost with inorganic fertilisers was not included in the trial because growers will not make compost although this gives excellent results on the Experiment Station.

479. Trials with Chinese vegetables have continued at Kuala Lumpur and an experiment with lobak (Chinese radish) has shown that two local varieties were superior in yield and appearance to four Japanese strains.

480. A spacing trial with a soft-shelled variety of Job's Tears (*Coix*) gave the following results:

Spacing		Yield of Dried Unhulled Grain (lb. per acre)
2 × 1 ft.	...	730
1½ × 1 ft.	...	920
1 × 1 ft.	...	1,260

This crop is susceptible to damage by rain and it shatters easily. Unhulled grain is preferred to hulled grain for seed purposes as it gives much better germination.

(N).—Miscellaneous Crops

481. There is continued interest shown by commercial firms in America and Europe in botanical drugs and the following plant products have been sold to interested firms:

Rauwolfia perakensis—dried roots.

Garcinia mangostana—bark, latex and dried husks.

Orthosiphon stamineus—dried leaves.

(O).—Horticulture

482. Very good results have followed the use of polythene sheet for making marcots (air-layers) and this can now be considered a standard method of propagation. Rooting of some subjects takes only three weeks.

2.—LIVESTOCK

(A).—Goats

483. The goat feeding trial at Bukit Mertajam was nearing completion at the end of the year. Animals fed on a kampong ration of cut fodder grass and tree foliage, with a rock salt lick, grew more slowly and produced a leaner meat than those given a balanced ration of grass and concentrates but some of

the former nevertheless do quite well. This suggests that a compromise might give the best results whereby the young animals are fed on a high plane of nutrition and later finished off on kampong rations.

484. The Serdang herd has been used to test palatability of experimental fodder and pasture crops. This work has been associated with losses caused by acute diarrhoea. During the year 37 kids were born, 34 animals died and 25 were distributed.

485. It is now clear that meat is more important than milk production in Malaya.

(B).—*Pigs*

486. Observations have been carried out at Pulau Gadong, in Malacca, and Serdang on the comparative merits of Wessex, Large White and Large Black boars for serving Chinese Black sows.

487. Growth rate of Wessex half breds is reported to be superior to that of the standard Chinese Black x Middle White cross and one boar has served 54 sows. The cross breds have killed out a 70 to 72 per cent. and carcase quality was said to be satisfactory.

488. Large Black and Large White boars soon grow too big for serving local sows but the former breed is popular in certain localities as it stands up well to sun exposure.

(C).—*Bali Cattle*

489. Health of the Serdang herd has remained excellent. One heifer and five bull calves have been born during the year but there have been no deaths. However, one calf was destroyed because of acute rheumatism.

C.—EXTENSION AND ADVISORY WORK

1.—CROPS

(A).—*Rubber*

490. Of the total area under rubber in Malaya, practically half is comprised of medium and small holdings of less than 100 acres each. The Department is closely concerned with extension and advisory services to the owners of these medium and small holdings and works in close association with the Smallholders' Advisory Service of the Rubber Research Institute of Malaya whose Instructors and Demonstrators operate throughout the country under the supervision of State or Settlement Agricultural Officers. The more important activities pursued in such association during the year included the demonstration and encouragement of the use of approved planting material, advisory work on new planting and replanting, control of pests and diseases, anti-erosion measures, and the use of fertilisers. Other lines of work undertaken, on a more local basis, were, firstly, advisory work on the collection of smallholding rubber latex for centralised processing or for subsequent sale as latex to large exporting firms and, secondly, the survey of areas undergoing new planting. These surveys not only made it possible to keep a tally on the use of approved planting material, as stipulated in

the express conditions attached to all new rubber planting titles, but also, by providing the State or Settlement Agricultural Officer with accurate information of the whereabouts of land scheduled for planting and the progress made, has enabled him to plan, with a reasonable degree of accuracy, his nursery programmes for the production of approved planting material.

491. Although Government policy in general is directed primarily towards securing the maximum amount of replanting with high yielding trees and requires that replanting should normally take precedence over new planting, nevertheless, in those areas where ample land is available and where no alternative crop of equal or nearly equal economic value to rubber can be grown, new planting is being permitted by State and Settlement Governments. New planting may also be permitted as part of a planned settlement scheme, as happened in Kedah during 1955 when some 40,000 acres of land was alienated for new planting with rubber. In Johore, the State Government has approved a proposal to plant 75,000 acres with new rubber during the period 1955 to 1960. To assist in the supply of planting material for new planting, funds have been placed at the disposal of the State and Settlement Agricultural Officers by their Governments for the establishment of budwood and clonal seedling nurseries.

492. It has been stated that the Rubber Replanting Scheme in this country is, in importance and scope, unparalleled elsewhere in tropical agriculture. Its scope is certainly considerable, and in its successful operation the Department has an important part to play. On the Department devolves the responsible task of producing all the approved planting material required for the smallholders' section of the Scheme.

493. Approved planting material takes the form of either budwood or clonal seedlings. In regard to the former, nurseries of the clones PB. 86, Tj. 1, and RRI. M501 and M513 were maintained on areas totalling 84 acres (of which 70 acres was in full production and 14 acres was in course of establishment) on Agricultural Stations throughout the Federation. Compared with a total of 85,269 yards of budwood issued in 1954, 127,661 yards, i.e. an increase of 42,392 yards, was supplied to the Rubber Industry (Replanting) Board in 1955.

494. Clonal seedling stumps continued to be the type of planting material favoured by smallholders (except Chinese, who favour budding) and the policy was followed, as far as circumstances permitted, of establishing an adequate acreage of clonal seedling nursery in each State and Settlement to meet local replanting requirements. The nurseries, ranging from one to 50 acres and over, are sited on large rubber estates, smallholdings and Agricultural Stations and are managed either on contract or by direct labour. In 1955 it was, for the first time, possible to satisfy the demand for clonal seedlings and at the end of the year there was actually a surplus. The total number of clonal stumps produced and issued to State Replanting Officers was 4,247,620 compared with 3,105,220 in 1954. Altogether 1,199,069 stumps were sold for new plantings.

495. The following tables give the total acreages of new and replanting on smallholdings and the distribution of improved planting material for the past five years:

		New Planting (acres)		Replanting (acres)
1951	...	5,588	...	3,778
1952	...	6,725	...	4,250
1953	...	6,339	...	21,971
1954	...	not available	...	27,730
1955	...	7,900	...	21,190

DISTRIBUTION OF IMPROVED PLANTING MATERIAL

	1951	1952	1953	1954	1955
Budwood (yards) ...	39,489	46,936	68,105	122,564	190,110
Clonal seedlings ...	1,575,797	1,535,715	1,773,388	3,318,643	5,446,689
Seed ...	1,131,093	400,000	893,750	981,782	1,128,700

496. Nursery work on the large scale now practised requires a high standard organisation, for a number of not readily predictable factors are involved such as the weight of seed-fall, viability of seed and weather conditions at the time of establishment. As would be expected, mechanisation has been introduced wherever possible, but it is still the practice, however, for all seeds to be planted by hand, after germination in specially prepared beds.

497. Clonal seedlings are generally transplanted at an average age of nine months, that is, one year's sowing is the next year's planting. Seed collection during 1955, in anticipation of clonal seed requirements in 1956, totalled 19,000,000 seed, compared with a total of 12,332,644 seed in 1954. By far the biggest single producer of seed was the State of Selangor, where 10,790,000 seed were collected during the periods of the annual 1954-55 seedfalls. Collection was done by field staff of the Department and valuable assistance was received from officers of the Rubber Industry (Replanting) Board, who helped in the search for new sources of seed, and from officers of the Rubber Research Institute who, after examination of representative samples of seed, approved or rejected the sources once they had been found.

498. Wide publicity continued to be given to the need for strict control of lalang (*Imperata cylindrica*) on all holdings planted with young rubber, and where conditions were favourable a policy of inter-cropping with vegetables and food crops, having due regard to adequate manuring, is not discouraged.

(B).—Padi

499. The key to success in extension work lies in the maintenance of an excellent farmer-Department of Agriculture relationship, and this principle is closely observed by the extension staff of the Department.

500. In addition to the eight large, purely experiment stations in the Federation, 38 smaller test stations, purposely sited to embrace the different sets of conditions encountered

throughout the main padi-growing areas, are maintained and operated by the Field Branch of the Department. Their purpose is three-fold, firstly to accommodate extension trials with either fertilisers or new varieties, secondly to multiply improved strains for seed purposes, and thirdly to demonstrate improvements in techniques such as nursery management, spacing and fertiliser application.

501. Greater use has also been made in recent years of the Malay peasants' ready willingness to co-operate with the Department—a testimony, incidentally, of the friendly relations which exist—and in the 1954-55 season 3,095 extension trials and demonstrations (1,629 with fertilisers and 1,466 with new varietal selections) were planted on privately owned land. The number of such plots was limited by shortage of field staff and lack of funds, and not because the total was considered adequate for the purposes for which they were designed. These trials, which are conducted on cultivators' own lands, are fast becoming demonstrations and centres of attraction in the Department's extension work.

502. The Malay farmer, in common with farmers all over the world, is frequently described as conservative. That may be, but he is seed conscious to a marked degree and seldom neglects an opportunity of trying out a new variety or selection. This characteristic has been of great assistance in variety extension, and in Malacca and Negri Sembilan, where the selection programme has reached the stage of controlled release of certain strains, there has been no lack of willing individuals to carry out trials. Serendah Kuning is a variety which does very well in Negri Sembilan, and selections of this have been under trial there for two seasons. In Malacca during the 1954-55 season, 60 one-acre seed farms under private ownership were planted with selected varieties to bulk up supplies of seed of Serendah Kuning 3 and Reyong 6; in the 1955-56 season, a further 60 seed farms were planted with Nachin 57 and Serendah Kuning 3. A strain which is becoming very popular with the padi planters in Kedah is Burma A. 28/8, and this was especially so during the 1955-56 season when planting was delayed by lack of water.

503. A total of 46,853 gantangs (gallons) of padi seed was supplied from Departmental sources on a cash or exchange basis. Most of this seed was made up of selected strains, the balance being rogued, mass selected seed grown on Padi Stations.

504. Some concern had been expressed concerning the progress of the State Government-controlled Padi Fertiliser Subsidy Schemes in Kelantan and Trengganu. The Scheme in Kelantan is now in its fourth year and that in Trengganu in its third year. There had been a decline in the amount of fertiliser sold in Kelantan from 720 tons in 1953 to 296 tons in 1954. There was a recovery however in 1955, when sales reached a record level of 820 tons. This fertiliser would be applied to approximately 5 per cent. of the planted acreage in Kelantan, i.e. about 8,200 acres. In Trengganu, the fluctuations in sales of fertiliser have been smaller, and in 1955, 47 tons was distributed, compared with 53 and 49 tons in 1953 and 1954 respectively. Kedah is another

State where the cultivators purchased inorganic manures, mainly bat guano, in quantity, although no subsidy scheme is in operation; and during 1955 over 3,000 tons was sold, compared with 492 tons in 1954. Toward the end of 1955, Malacca and Trengganu introduced subsidised fertiliser schemes as a result of a special Federal Government grant; the new scheme in Trengganu took the place of the State-controlled scheme. The usual subsidy is 50 per cent. of cost price, i.e. about \$15 per acre.

505. An item of considerable importance to most padi planters which occurred during 1955 was the announcement that the Government guaranteed minimum price for padi was to be reduced from $12\frac{3}{4}$ to 9 cents per lb. As a result of widespread complaints, the Federal Government set up a Committee to enquire into the economics of padi planters. Its recommendations were:

- (i) from the long term point of view: control of rent for land and security of tenure for tenants; and
- (ii) from the short term point of view: that funds should be provided for assistance to padi planters.

506. To deal with the second recommendation, a total of \$10 million was allocated to State and Settlement Governments in proportion to their acreages of padi and the amounts of padi normally sold by the planters for cash. The States and Settlements concerned then set up Committees to decide how this money should be used for the benefit of the padi planting community.

507. The padi planters, however, were still not satisfied, and as a result of repeated protests, the Federal Government agreed in December, 1955, to raise its guaranteed minimum price from 9 to $10\frac{1}{2}$ cents per lb. This concession came too late to be of much use during the 1955-56 padi season, and this undoubtedly had an adverse effect on the sales of fertilisers and seeds to padi planters. If the price of padi falls below a certain level the application of fertilisers becomes uneconomic, yields are reduced if fertilisers are not used and so more rice has to be purchased from abroad to maintain supplies and stocks. If the efforts of the Department to increase total rice production are to meet with success, the growers must know what return they can expect as far in advance as possible.

508. It is hoped that in the 1956-57 season, provided the subsidy can be maintained at 50 per cent. of cost price, larger quantities of fertilisers will be sold.

509. To implement the first of the recommendations mentioned above, the Kedah Government passed the Kedah Padi Planters' Board Enactment in December, 1955. This allows, among other things, for all money voted by the Federal Government to assist padi planters to be used for such purposes as combating the evil of "Jual Janji" (land mortgage) and for other general assistance.

510. Another great step taken in this State was the formation of an Association of Padi Planters and Divisions of this Association in the 18 areas proposed by the Kedah Rice Committee. Rules have been drawn up for the Association and its Branches.

511. A new Enactment brought into effect in many States was the Rent Control Enactment. Briefly, this guarantees security of tenure to an industrious tenant, unless the owner himself wishes to plant the land. Rent is restricted to a maximum of one-third of the total crop, payable in cash or kind.

512. A survey of padi planters in Perlis by the State Agricultural Officer, Kedah and Perlis, produced some interesting information. Results showed that 62.3 per cent. of cultivators are working Class I land, 34.4 per cent. Class II land and 3.3 per cent. Class III land. The average size of holding varies with the class of land and race of the cultivator, the relative figures being, in relongs (1 relong=0.71 acre):

		Per cent. of Padi Planting Population	Class I	II	III
Malays	...	93.5	7.2	5.2	4.5
Chinese	...	3.8	12.0	6.3	Nil
Thais	...	2.7	9.5	7.0	4.3

513. It has been calculated that the cash value of surplus padi obtained by the various types of farmer per holding per season is as follows:

Class I Land—

Malay tenant \$189	Malay owner \$561	Malay owner/tenant \$542
Chinese tenant \$505	Chinese owner \$1,227	

Class II Land—

Malay tenant \$123	Malay owner \$260	Malay owner/tenant \$320
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Class III Land—

Malay owner \$76.

514. A similar survey just completed in Kedah has provided the following results applicable to the main Kedah Plain:

AVERAGE SIZE OF HOLDINGS

(Relongs)

		Per cent. of Padi Planting Population	Class I	II	III
Malays	...	95.42	5.92	6.65	5.3
Chinese	...	4.13	11.4	10.4	Nil
Thais	...	.45	Nil	5.7	3.8

CASH VALUE OF SURPLUS PADI

Class I Land—

Malay tenant \$212	Malay owner \$553	Malay owner/tenant \$622
Chinese tenant \$551	Chinese owner \$1,275	

Class II Land—

Malay tenant \$95	Malay owner \$354	Malay owner/tenant \$369
Chinese tenant \$325	—	—
	Thai owner \$388	

Class III Land—

Malay tenant \$39	Malay owner \$98	Malay owner/tenant \$152
—	Thai owner \$50	—

It is estimated that on the Class III land more than three-quarters of the planters have an income from another source, probably at least a small area of rubber. In comparison, less than 50 per cent. of cultivators on Class I and II lands obtain any appreciable income from other sources, and are clearly producing padi for the commercial market.

515. These figures were based on the price of padi in December, 1955—\$14 per picul (133½ lb.).

516. The economic survey being conducted by the Agricultural Economist has entered its final stages in Kedah, Perlis and Province Wellesley. In Kelantan, the first stage is nearing completion. All these surveys will be completed in 1956.

517. Efforts to introduce or extend the practice of double-cropping padi land have been made in several States and Settlements. In Kelantan, a trial at Lundang Paku in a small Pumped Irrigation Scheme almost failed due to an exceptionally dry off-season, but water was diverted to the area from the Salor Irrigation Scheme. However, the trial was so promising and the planters so keen that a further attempt is to be made in 1956 with a more reliable water supply. Seed, fertilisers and insect pest control measures were all supplied by the Department of Agriculture. Double-cropping in parts of Province Wellesley is a standard practice using short-term Taiwan padi. In Malacca, a double-cropping trial was carried out on an area of 24 acres; the area was fenced and manured with the aid of Departmental funds. Here again, however, unseasonal dry weather in March and April caused failure of the crop.

518. Past endeavours by the Department to extend the aggregate area double-cropped annually with padi have not been wholly successful, and experience indicates that, for success, the areas must be sufficiently large for pest damage to be as little concentrated as possible, must have an assured water supply, close and regular supervision is essential, care is necessary in selecting only those farmers known to be co-operative, and, in the initial stages, some form of Government assistance may be necessary.

519. Off-season planting of padi fields with crops other than padi continued to be practised extensively in Malacca, Kelantan and Selangor. The Department strongly favours this system of farming, for trials have shown that the beneficial effect on the subsequent padi crop is considerable, and, moreover, the practice makes for a more stable economy.

520. Control of pests of padi is a routine function of the staff of the Field Branch of the Department. Rats are always a major pest and over 600 lb. of zinc phosphide and barium carbonate were used in the preparation of poison baits for them. Insect pests are controlled with various types of insecticides, and equipment is usually available on loan from the Department to people wishing to spray or dust their crops. In Kelantan, three "Swingfog" machines have been purchased and the Department is operating a Pest Control Service which is available on demand to deal with any reported outbreaks.

(C).—*Pineapple*

521. Pineapples are an important smallholders crop in Selangor and Johore. They are grown either as a pure stand or as an intercrop in newly replanted rubber holdings. Most of the crop is grown for the canning trade but smaller and more isolated areas provide pines for the fresh-fruit market.

522. One of the major successes of the Department in Johore was the formation of co-operative societies among the smallholders. For the whole of the post-war period it has been the policy of the Department to foster and encourage such ideas. The registration of the Pekan Nanas Pineapple Co-operative Marketing Society took place during the year, and this represents an important step forward in Pontian District. Two similar societies have been formed in Muar District.

523. The use of hormone sprays, which has proved so successful on pineapple estates, has not yet spread to smallholders. This is probably a good thing, because the widespread and indiscriminate use of these sprays by smallholders might have an undesirable effect on fruit harvests.

524. Green Die-Back, at one time a very common physiological disturbance of pineapples, now appears only rarely, due to regular spraying with Bordeaux mixture using Departmental and private equipment.

525. During 1955, 750 acres of new planting by smallholders was reported from Johore, including 382 acres planted as an alternative crop under the rubber replanting scheme. In Perak, 150,000 suckers were obtained by the Department and distributed to smallholders under a scheme to start a new industry for them in the State. This scheme was planned by officers of the Department. In addition, 50,000 suckers were distributed in Selangor. Manurial demonstration plots in Johore on cultivators' land have aroused much interest as yields and quality of fruit have been improved.

(D).—*Fibres*

(i) JUTE

526. Following a small-scale trial on cultivators' land in Selangor in 1954, efforts were made to extend the cultivation of this crop during the off-season in the coastal padi area of that State. Seed had been multiplied on an Agricultural Station and sufficient was available to plant 150 acres. Only 37 acres was in fact planted, but the weather was abnormally dry and the majority of the plots failed. This was most unfortunate, as the crop could be very profitable and smallholders in this particular district were taking more and more interest. However, six acres was harvested, and the entire crop of fibre, which yielded at an average of 776 lb. per acre, was bought at 20 cents per lb. under a scheme financed by the Rural and Industrial Development Authority. One of the main drawbacks to future progress with this crop is the hard work involved in manual stripping of the fibre, and mechanisation of this part of the work should assist greatly.

(ii) MANILA HEMP

527. No interest has been shown in Manila hemp as a smallholders crop, but stocks of planting material are kept on Agricultural Stations in most States and Settlements to supply any demand which may arise.

(E).—*Other Crops*

528. Reports from all State and Settlement Agricultural Officers on the progress of the Rubber Replanting Scheme show that a considerable amount of work is being done by the staff of the Department in inspecting land which the owners wish to replant with alternative crops. To date, a total of 7,771 acres has been so replanted. Of these alternative crops, coconut is the most popular, with fruit, coffee, padi, pineapple and sago also being in demand. On receipt by the State Replanting Officer of an application to replant with an alternative crop, the land is inspected by the staff of the Department of Agriculture, and if it is found suitable for the proposed crop, approval is given. Where possible, approved planting material is supplied by the Department.

529. One great advantage of this scheme is that holdings are regularly inspected and manured, and as a result, standards are well above those normally found.

(F).—*Planting Material*

530. The number of budded fruit trees distributed from Departmental nurseries during the year showed a further increase over 1954, which was the previous best year. The following figures show how the increase has been maintained over the five years:

	1951	1952	1953	1954	1955
Budded fruit trees distributed	13,331	16,870	26,781	39,898	50,582

531. The total of selected fruit tree seedlings distributed was 10,945, an increase of 7,747 over 1954.

532. Small commercial fruit multiplication nurseries have been opened in Perak; North Johore and Selangor, and one is to be opened in Penang in 1956. These nurseries can make an important contribution to the number of fruit trees available to the public because in spite of the rapid increases in production from Agricultural Stations, the demand still exceeds the supply in almost every State and Settlement. The Department is in all cases exercising strict control of these commercial nurseries in order to maintain the high standards required.

533. There are several reasons why Departmental nurseries have not been able to meet the demand. The first of these is the rapid rate at which orders were received when fruit trees planted in the immediate post-war years began to fruit. The second main reason has been shortage of budwood, but this has by now been attended to, as all the larger Agricultural Stations now have their own budwood nurseries which have, or are about to, come into full bearing. In addition, overhead irrigation systems have been installed in many of the bigger nurseries and as a result growth rates of the seedling plants have increased.



Kuala Langat District, Selangor. This coffee was planted on old rubber land four years ago



534. Coffee seedlings have been supplied to smallholders in large numbers, especially in Negri Sembilan, Malacca, Johore and Selangor, where the crop has been planted on 1,400 acres of old rubber land under the Rubber Replanting Scheme. During the year, the Agricultural Engineer developed an improved type of huller to help in the processing of the beans. The huller gave a good sample, but as there appears to be no demand on the local market for a well-prepared sample, smallholders showed little interest in it.

535. As a side-line, the production of flowering and shade trees is undertaken, mainly on behalf of new villages and Government Departments.

536. The Department does not enter the commercial market as a supplier of vegetable seed, but small quantities of improved types are always available free on demand to interested growers for trial. Also, when occasion demands, the Department assists in the procurement of planting material from private growers, if it cannot be supplied from Departmental sources, as in the case of coconuts, pepper cuttings and pineapple suckers for growers in various parts of the country.

(G).—*Amelonado Cacao Seed Gardens*

537. Seed gardens of Amelonado cacao aggregating 82 acres are established in all States and Settlements; the total area in 1953 was 50 acres and in 1954 was 85 acres. The slight reduction in acreage is due to the abandonment of a small nursery in Johore. The purpose of the gardens is two-fold; as a source of seed for smallholders when development of the crop is undertaken, and as centres to demonstrate techniques relating to cacao husbandry. In addition to these particular seed gardens, all of which have been established under thinned jungle, i.e. in accordance with presently accepted practice, there exists a number of observation plots in Perak and Pahang where the top shade is provided by fruit trees. These plots show distinct promise. Some excellent cacao is growing under coconuts at Kuala Bernam in Perak, and also in Province Wellesley.

538. The "Report of the Working Party set up to Consider the Development of a Cacao Industry in Malaya" was published in June. The most important recommendation, as affecting the Department of Agriculture, was that dealing with the establishment of pilot schemes, of which two of about 50 acres each are envisaged for 1956.

539. In this connection, Trengganu has taken the lead, and a small-scale pilot scheme was started late in 1955. Twelve smallholders will participate in the scheme, each family having four acres of cacao and two acres of dusun or padi land. The land will be alienated to the Rural and Industrial Development Authority in the first place, and the Authority will pay all alienation costs and fees. Each participant will also be granted a loan of up to \$600 for the purchase of planting material, baskets, fertilisers, etc., and each man will be paid \$1.50 for each day worked on the scheme. The loans will be repaid in

Pods when the cacao comes into bearing. The participants will work co-operatively until the crop comes into bearing in 1960-61, and each will then receive his four acres. This is the first scheme of its kind in Malaya and the results will be awaited with keen interest by all connected with the industry.

540. A similar scheme has been suggested for Pahang, but details have not yet been finalised.

2.—MECHANISATION

541. The demand for assistance by Departmental tractors for ploughing and cultivating agricultural land showed a slight increase over that for 1954. Commercially-owned tractors and tractors and machinery owned by the Rural and Industrial Development Authority are now dealing with the larger part of small-holders' requirements and Departmental tractors are used mainly on land near Agricultural Stations.

542. Although the cultivation of wet padi land using tractors has been fully demonstrated, the expense appears to be the main drawback to more widespread use being made of mechanical methods. There is still a steady demand for cultivation of dry land however. Figures of acreage ploughed using tractors belonging to the Department are:

Wet padi	115 acres	
Dry padi	85 acres	(all operations completely mechanised)
New village agricultural land	170 acres	
Department of Agriculture rubber nurseries	99 acres	
Miscellaneous	442 acres	

543. A demonstration of mechanical harvesting and threshing of dry padi was given on a four-acre holding in the land development scheme at Paya Besar, Pahang. There is now a total of 135 acres planted, 50 acres opened during 1954 and a further 85 acres in 1955. On the 50-acre block, all cultivations were done by two participants in the scheme using mechanical equipment. Harvesting on the demonstration holding was completed in about five hours and the swift, efficient handling of the crop, as compared with normal harvesting methods, provided a lesson which greatly impressed the onlookers.

544. In Selangor, a mechanical thresher was again working in the coastal padi area. A total of 891 pikuls (1 pikul = 133½ lb.) was threshed, at a charge of 1 pikul for each 20 pikuls treated.

544A. Mechanical planting of 28 acres of dry padi was undertaken with mechanical equipment at Kuala Akob, Trengganu, as the first operation in a R.I.D.A. Scheme to replace shifting cultivation with a more stable system based on annual cropping with dry padi and off-season cropping with vegetables.

3.—LIVESTOCK

(A).—Pigs

545. The success of the imported Middle White breed, brought to Malaya by the Department some years ago, is shown in the large numbers of pure and half-bred Middle Whites now found in new villages all over the country. During the second

quarter of the year, more than 50 per cent. of all pigs slaughtered at Malacca abattoir were cross-breeds (Chinese Black × Middle White). This represents the Department's most successful line in extension work.

546. The Department gives every assistance to rearers wishing to buy or use Middle White boars, and stud boars are maintained on Agricultural Stations and in new villages in most States and Settlements. Most rearers favour the first cross Chinese Black × Middle White, and there is therefore a good demand also for Chinese Black gilts. The Chinese black sow is a better mother, and the Department does not encourage the use of pure-bred Middle Whites as sows. The Department stud centres do not distribute the Chinese breed but will assist in arranging the sale or purchase of them when necessary.

547. During the year, total distributions amounted to 286 young boars and 231 gilts. New stations recently opened up should enable this figure to be increased next year.

548. A comparatively new venture now gaining popularity is combined pig and fish farming. The layout is so planned that the fishponds lie below the pigsties and can utilise the pig manure. Fruit trees are usually an additional feature of such farms. There are now several established in Penang and Perak.

(B).—Poultry

549. The Department's policy aims at no more than meeting the public demand for pure-bred stock. Demonstration flocks of imported breeds—Rhode Island Reds, White Leghorns and Australorps—were kept at most Agricultural Stations and such local demand as existed was met by the distribution of cockerels, pullets, unsexed day old chicks, and hatching eggs. Sales were as follows: cockerels 946, pullets 903, unsexed day-old chicks 4,658 and hatching eggs 10,721. These sales fulfilled a useful double purpose by helping to meet the demands for day-old chicks and stabilising charges made by commercial hatcheries, of which a number existed in the various States and Settlements.

550. In order to maintain or improve the quality of flocks on Agricultural Stations, large-scale importations of hatching eggs from England and Denmark were made by the Department in Selangor. Eggs from these importations were sent to several other States and Settlements. The breeds imported were Rhode Island Red, White Leghorn, Light Sussex, and a promising breed new to Malaya, the New Hampshire Red.

551. There have been so many failures amongst those would-be poultry breeders already granted loans from the Rural and Industrial Development Authority that loans are now granted only after applicants have undergone a short course, held under the auspices of the Department, on the basic principles of successful poultry husbandry.

552. The high cost of feeding stuffs, both imported and locally produced, remained the major drawback to general success with poultry. The disease problem has been greatly lessened thanks to the inoculation campaign of the Veterinary Department.

553. There has been a disappointing lack of interest in raising pure-bred birds in the kampongs due to a lack of marketing facilities for the eggs produced and also to the size of the carcase, which is too large for the average family.

(C).—Goats

554. No new importations of goats were made last year, and the efforts of the Department were confined to bulking up existing herds of British Alpine, Saanan and Anglo Nubian at various Agricultural Stations.

555. Due to a case of Melioidosis discovered in the Department's flock at Penang, all distributions of goats to the public were suspended. The Veterinary Department undertook to examine and test all herds on Agricultural Stations to determine the extent of the disease.

556. As a result of these restrictions, only 10 young bucks were sold or distributed to smallholders.

4.—PESTS

557. There were no serious outbreaks of pests or diseases reported during the year. Rats, bandicoots and squirrels were still the worst pests found, and over 1,500 lb. of zinc phosphide was distributed in poison bait in an effort to control them. The Department's shotguns and ammunition were used in several States and Settlements. The total reported kills were:

Rats	...	...	...	...	242,521
Bandicoots	...	...	...	...	12,649
Wild pigs	...	...	...	...	1,737
Squirrels	...	...	...	...	8,107
Monkeys	...	...	...	...	1,590
Others	...	...	...	...	496

558. The attacks of the Coconut Beetle (*Oryctes rhinoceros*) have caused heavy damage and losses in coconut plantations and also in oil palm estates. Staff of the Department in all States and Settlements are now keeping a close watch on possible breeding grounds. Action has already been taken to clear up many obvious breeding sites, and conditions in parts of Selangor are said to have improved considerably as a result of this. In Johore, the Red Stripe Weevil was occasionally found associated with the Coconut Beetle in oil palms.

559. Insect pest attacks on padi were again widespread, but with the prompt use of new spraying and dusting equipment and a variety of insecticides the Field Staff of the Department were able to deal effectively with nearly every case.

5.—NEW VILLAGES

560. Although most new villages have by now been established for some time, the rate of development of the agricultural areas has in some cases been slow due to shortage of suitable land. Even during 1955 the Department was able to give considerable assistance to the more backward areas. This assistance

generally took the form of clearing and ploughing vegetable land, the provision of drains and fences, the provision of seeds, planting materials and livestock, and constant advice and demonstrations on better methods of husbandry. In Johore alone, over 1,600 acres was drained or in the process of being drained, 415 acres of land was fenced, and a further 297 acres ploughed and cultivated.

561. Manurial demonstrations on lands in Johore resulted in the sale of 99½ tons of fertilisers at subsidised prices.

562. In Kelantan, a New Villages Aided Rubber Scheme is in operation. Administered by an Emergency Administrative Officer, with the active assistance and co-operation of the Department, the Scheme provides for the planting of 3,000 acres of rubber on land near new villages over a period of three years. Some 626 acres had been planted up with clonal stumps by the end of the year, and the remainder of the first year's 1,000 acres should be planted early in 1956.

6.—SETTLEMENT SCHEMES

563. Land Settlement Schemes for time-expired Special Constables have occupied the attention of officers of the Field Branch in varying degree. Demands for planting material—of pineapple, fruit, coffee, etc.—were accorded priority and generally were fulfilled without appreciable delay; similarly with demands for poultry. Shortage of staff rendered it impossible for State and Settlement Agricultural Officers to give attention to individuals, but where group settlement had taken place, considerable time was devoted to close supervision of the work undertaken, for many of the settlers possessed no previous agricultural experience. There are three such group settlement schemes in Johore, accommodating a total of 87 ex-Special Constables and their families. Supplies to these groups during the year totalled 5,870 budded rambutans, 176 other fruit trees, 2 cwt. of cover crop seeds, 4,860 coffee seedlings, and 92 cwt. of fertiliser at half price.

564. There is a similar scheme in Kedah, where the chief crop is to be rubber. Altogether 31 men are concerned, and to-date 32 acres, out of the total of 93, has been planted up. It is hoped that a second scheme for 12 men will follow on these lines in 1956.

565. Of the eight schemes in Perak, four have had very little success, due almost entirely to lack of enthusiasm on the part of the settlers. Most of these schemes are for rubber planting.

566. The largest single scheme is at Kampong Jaya Stia in Selangor. Each of 177 settlers has been given a house lot and four acres of land. The main crops in the scheme are coffee and pineapple, and to-date over 130 acres has been planted with coffee. The Department maintains a coffee seedling nursery and demonstration plots within the scheme.

567. Smaller group schemes are reported from other places in Selangor; in particular two schemes of 40 acres each for Aborigines. Chief crops are coffee and dry padi.

7.—RURAL AGRICULTURAL TRAINING

568. Emphasis continued to be placed on Rural Agricultural Training as part of the Department's activities and the usual diverse lines were followed, ranging from visits and lectures in villages to organised demonstrations and residential courses at Agricultural Stations.

(A).—*Courses at Agricultural Stations*

569. The established farm schools in Kedah, Selangor, Perak, Pahang and Negri Sembilan continued to run courses, varying from one week to three months duration, throughout the year. A total of 666 people attended a total of 51 courses covering all branches of crops and animal husbandry. The courses have proved very popular, especially with the aborigines who attended them, and there is usually a waiting list of applicants. Funds were formerly provided by the Rural and Industrial Development Authority, but these were withdrawn in 1955 and State Governments now finance the courses.

570. During 1955, school buildings were started or completed in Johore, Malacca, Penang and Kelantan, which means that during 1956 courses will be run in every State and Settlement except Trengganu.

(B).—*Civics Courses*

571. Civics Courses have come to be accepted as part of Government's drive to create a feeling of civic consciousness among the people. The Department has always played its part in these courses and endeavoured to demonstrate particular agricultural services available to the public and to explain how best the farmer can make contact with its officers when in need.

572. During the year, over 60 such courses were addressed by members of the Field Staff of the Department and visits were arranged to Agricultural Stations and other places of interest.

573. A six-day staff refresher course for Agricultural Assistants was held at the College of Agriculture and was attended by 20 officers.

(C).—*Lectures and Talks*

574. Lectures and talks given by members of the Department are too numerous to list in detail, but included talks, illustrated with slides, on pig and poultry husbandry in new villages in Johore, and talks and discussions on such subjects as the principles of agriculture, rubber and fruit tree cultivation, bud-grafting and nursery technique for smallholders, use of manures and improved seeds, and so on.

575. Full use was made of equipment provided by the Department of Information, whose officers assisted in the showing of various films, including one called "Padi Planting in Japan" which was shown all over the country.

(D).—*Agricultural Shows and Padi Competitions*

576. Mukim (parish), District and State Agricultural Shows were held in several States and Settlements during the year in preparation for the Malayan Agri-Horticultural Association

Exhibition in Kuala Lumpur. These shows always attract large numbers of people and are used by all branches of the Department as "shop windows" to demonstrate any new methods of husbandry, new varieties of crops or new breeds of livestock which have been successfully used or grown during the previous 12 months.

577. Padi competitions are now an annual event in almost every District and Mukim in the padi growing areas. Winning entries compete at the State shows, and winners from there compete in the All-Malaya Padi Competition. These competitions arouse great interest from growers and form a very valuable factor in the improvement of padi seed.

(E).—*Agricultural Newsletter*

578. Agricultural newsletters, printed in the vernacular and expressly edited with a local bias, were published and distributed free in six States and Settlements. The increased correspondence received after the issue of each number bore witness to the fact that the publications were read and, moreover, had stimulated the interest of the farming communities. This is considered an important line of extension as it makes for the maintenance of an even closer link than now exists between farmers and the Department. Newsletters, first put out in Kedah, are now produced by the Department in Pahang, Johore, Negri Sembilan, Penang and Malacca. They are usually issued every three to four months, with a distribution of between 5,000 to 12,000 per issue. Among subjects of general interest discussed in the newsletters was the Rent Control Ordinance that was introduced during 1955.

D.—AGRICULTURAL EDUCATION

1.—ADVISORY COUNCIL

579. The council met once during the year, on the 21st February.

580. The present membership of the Council, as reconstituted by the Hon'ble the Minister for Agriculture, is as follows:

The Director of Agriculture, Federation of Malaya (*Chairman*)

The Director, Veterinary Services, Federation of Malaya

The Principal, Sultan Idris Training College, Tanjong Malim

The Principal, College of Agriculture, Malaya

The Director, Rubber Research Institute of Malaya

The Hon'ble Mr. H. A. Campbell, C.B.E., Representative of the Rubber Producers' Council of the Federation of Malaya

Mr. Gunn Lay Teik, O.B.E.

The Hon'ble Enche Hashim bin Awang, J.P.

Dato' Jaffar bin Mampak, O.B.E.

Enche Jamaludin bin Aji

Enche Senu bin Abdul Rahman

The Hon'ble Mr. Yap Kim Hock

Secretary of the Alumni Association, College of Agriculture, Malaya

The Registrar and Bursar, College of Agriculture (*Secretary*).

2.—COLLEGE YEAR

581. The year was divided into three terms, as follows:

3rd term, 1954-55, session—11th January to 6th April;

1st term, 1955-56, session—14th June to 2nd September;

2nd term, 1955-56, session—28th September to 15th December.

3.—REGISTER OF STUDENTS

582. The categories of students in training were composed as follows:

REGISTER OF STUDENTS, JUNE, 1955

Category	Malays	Chinese	Indians	Others	Total
DIPLOMA COURSE					
THIRD YEAR STUDENTS (1953-56)					
Federal Scholars	5	6	2	—	13
Private Students, Federal	—	2	—	—	2
Rubber Research Institute Students in Training	1	—	—	—	1
North Borneo Students in Training	1	—	—	—	1
	7	8	2	—	17
SECOND YEAR STUDENTS (1954-57)					
Federal Scholars	5	9	1	—	15
Private Students, Federal	—	3	1	—	4
Negri Sembilan State Scholar	1	—	—	—	1
Singapore Scholar	—	1	—	—	1
	6	13	2	—	21
FIRST YEAR STUDENTS (1955-58)					
Federal Scholars	11	4	—	—	15
Private Students, Federal	—	3	—	1	4
Rubber Research Institute Students in Training	1	2	—	—	3
Singapore Scholar	—	1	—	—	1
	12	10	—	1	23
MINOR COURSE (1955-56)					
Probationer Junior Agricultural Assistants in Training... ..	19	1	—	—	20
Private Students, Federal	1	—	—	—	1
Malay School Teachers in Training, Selangor	1	—	—	—	1
Malay School Teachers in Training, Pahang	1	—	—	—	1
North Borneo Students in Training	2	—	—	—	2
Brunei Students in Training	3	—	—	—	3
	27	1	—	—	28
GRAND TOTAL ...	52	32	4	1	89

583. One Federal Government Scholar and two Private Students withdrew during the year. The Federal Scholarship so vacated was reallocated.

4.—TRAINING

584. The training in the Diploma Course followed, in general, the same lines as before. Nurseries, specially designed for training in budgrafting and marcotting techniques, have been planted. Practical training in rubber tapping and processing has been expanded. Instructional visits for training in tea production have been made to Cameron Highlands and in pineapple and coconut to Telok Anson. The help of estates in this training has been of great assistance.

5.—HEALTH AND RECREATION

585. The health of the students and labour force was good. There were no cases of serious illness.

6.—CATERING

586. This has remained a staff responsibility. A Hostel Superintendent was appointed on the 10th June.

7.—ALUMNI ASSOCIATION OF THE COLLEGE OF AGRICULTURE

587. This is very active and is growing in importance. The membership figures in 1955 were as follows:

REGISTER OF OLD BOYS BY OCCUPATIONAL STATUS

	Minor Course Students	Diploma Course Students	Total
Department of Agriculture	160*	109†	269
Other Government Departments	47	42	89
Rubber Research Institute	3	63	66
Penghulus/Assistant Penghulus	81	—	81
Salaried Employees, Estates	3	22	25
Salaried Employees, Commercial	4	20	24
Private Enterprise, Agriculture	33	8	41
Private Enterprise, Non-agricultural	3	5	8
Total Employed	334	269	603
Total Died	8	10	18
Total Untraced	60	28	88
GRAND TOTAL	402	307	709

* Includes 5 in North Borneo, 14 in Brunei, and 3 in Sarawak.

† Includes 2 in North Borneo, 3 in Brunei, and 10 in Sarawak.

	BY NATIONALITY				Total
	Malays	Chinese	Indians	Others	
Diploma Course ...	127	140	31	9	307
Minor Course ...	384	12	—	6	402
	511	152	31	15	709

8.—GENERAL

588. A Staff Refresher Course for Agricultural Assistants was held at the College from the 30th May to the 4th June.

E.—PUBLICATIONS AND LIBRARY

1.—PUBLICATIONS

589. The principal publications of the Department are the *Malayan Agricultural Journal* and Special Bulletins (General, Scientific, Economic and Mechanisation Series). Four issues of the Journal, i.e., Vol. 37, No. 4, and Vol. 38, Nos. 1 to 3, and one Special Bulletin were published during the year. The Bulletin was Scientific Series No. 26 "Rice Variety Trials in Malaya, 1950-54". In addition, the proofs of a revised Classified Index to the Journal (covering the period 1912 to 1954) were read; the Index is due for issue in January, 1956.

590. One leaflet in English (Agricultural Series No. 31—"Cacao") was issued in 1955. The proofs of four Poultry Leaflets (two in English and two in Chinese) and of one leaflet in Chinese dealing with cacao were read in December. The issue of leaflets in Malay was prevented by the lack of a Malay Translator during the last few months of the year; however a leaflet in Malay dealing with cacao was prepared and the report of the Cacao Working Party was translated for the Trengganu Government.

591. Several short articles were written and translated for the Chinese newspaper "Farmers' News", which is issued by the Department of Information Services.

592. The following summary shows which publications were printed during the year, together with the number of copies sold or issued free:

English	Sales	Free and Exchange	Total
MALAYAN AGRICULTURAL JOURNAL—			
Vol. 37, No. 4 ...	490	858	1,348
Vol. 38, No. 1 ...	467	841	1,308
Vol. 38, No. 2 ...	481	565	1,046
Vol. 38, No. 3 ...	456	685	1,141
			4,843
SPECIAL BULLETINS (Printed)—			
1. Rice Variety Trials in Malaya, 1950-54:			
Scientific Series No. 26 ...	55	250	305
LEAFLETS (Printed)—			
1. Cacao:			
Agricultural Leaflet No. 31 ...	—	515	515

593. The following summary shows the number of back numbers of the various publications of the Department distributed during 1955:

	Sales	Free and Exchange	Total
Malayan Agricultural Journal	689	391	1,080
Malayan Planting Manual No. 2	95	5	100
Special Bulletins	226	103	329
Agricultural Leaflets	—	431	431
Poultry Leaflets	—	313	313
Grow More Food and Educational Series ...	—	184	184
Malay Agricultural Journal	—	1	1
Leaflets in Malay	—	135	135
Chinese Agricultural Journal	—	22	22
Leaflets in Chinese	—	748	748
Tamil Agricultural Journal	—	840	840
Leaflets in Tamil	—	8	8
			4,191

594. The following is a summary of all publications sold and distributed during the year:

	Sales	Free and Exchange	Total
English	2,959	5,141	8,100
Malay	—	136	136
Chinese	—	770	770
Tamil	—	848	848
	2,959	6,895	9,854

595. Comparative figures for total revenue received during 1954 and 1955 from the sale of publications and from advertisements are as follows:

	1954	1955
	\$ c.	\$ c.
Sale of publications	5,254.50	5,052.80
Advertisements	1,979.72	1,686.25
	7,234.22	6,739.05

2.—LIBRARY

596. The Library contains about 3,750 books and reports published in book form and nearly 29,350 volumes of periodicals. There are approximately 1,050 unbound volumes of periodicals which are of earlier years and incomplete. The Library also contains many thousands of pamphlets and reprints. Approximately 1,350 periodicals are available.

597. Over 150 periodicals and all annual reports are circulated to members of the staff as they are received.

598. Additional floor space for extra bookshelves was acquired during the year and a certain amount of congestion was alleviated.

F.—SCHEMES SPONSORED UNDER THE COLONIAL
DEVELOPMENT AND WELFARE ACT (U.K.)

599. Brief particulars are given below of development schemes in progress under the control of the Department.

600. *Scheme D. 2115.*—A grant of £35,000 (\$300,000) was approved for the purpose of research and development work directed at establishing a cacao industry in Malaya. The scheme is designed to cover the period 1st January, 1954, to 31st March, 1956.

601. Investigations on cacao cultivation commenced in 1949 and much progress has been made, but these investigations have not yet reached the stage when conclusive recommendations can be made, and there is, therefore, a pressing need to continue research, more particularly on cultivation techniques in general. Expenditure in 1955 was \$108,100.01.

602. *Scheme D. 2203.*—A grant of £15,658 (\$134,211) was approved for a survey and investigation into the economics of padi production. The purpose of this investigation is to obtain an accurate assessment of the padi cultivator's true cost of production and to investigate other problems which are believed or known to affect production and which require detailed investigation. In addition, the survey will provide the basic information on the various factors upon which a sound policy for expanding rice production can be based. This scheme, administered in co-operation with the University of Malaya, commenced in 1954 and is due to end on the 31st March, 1956. Expenditure in 1955 was \$57,459.88.

603. *Scheme D. 2225.*—A grant of £31,900 (\$273,428.57) was approved for investigations into mechanisation of rice cultivation. The scheme is designed to assess the possibilities of mechanisation essentially as an aid to padi cultivation by the smallholder. It is proposed to begin a pilot mechanisation scheme of 50 acres sited in an area where through the construction of drainage and irrigation works a considerable amount of new land can be opened up for padi cultivation. The aim and object is to discover whether, with the aid of complete or partial mechanisation, a cultivator can plant a considerably larger acreage than he does at present thereby (a) producing a greater surplus of padi for disposal and (b) enhancing his standard of living. Expenditure in 1955 was \$52,384.46.

SECTION V

AGRICULTURAL LEGISLATION

1.—THE PADI CULTIVATORS (CONTROL OF RENT AND
SECURITY OF TENURE) ORDINANCE, 1955

604. An Ordinance to provide for the registration of tenancy agreements between landlords and tenant cultivators of padi lands, to control the rents reserved by such agreement, to provide security of tenure for tenant cultivators and for purposes incidental thereto. (Federation of Malaya Ordinance No. 9/1955 refers).

2.—OPEN GENERAL LICENCE (IMPORTS) (No. 1) 1955

605. Plants, including living plants of all species, flowers, fruits, leaves, roots, tubers, bulbs, cuttings, stock layers, slips, suckers, etc. (Legal Notification 86 of 17th February, 1955, refers).

3.—PESTS. DESTRUCTIVE INSECT AND PEST, ENGLAND.
IMPORTATION OF PLANTS ORDER, 1955

606. This Order consolidates, with amendments, the importation of Plants Orders, 1947 to 1954, the General Licence Orders made thereunder and the Importation of Raw Cherries Order, 1954. It prohibits or restricts the importation into England or Wales (except under licence) of specified plants, potatoes, seeds, vegetables and fruit and prescribes the forms of Health Certificate to accompany imports. This Order came into operation on the 1st day of April, 1955. (Legal Notification 153 of the 24th March, 1955, refers).

4.—PESTS. DESTRUCTIVE INSECT AND PEST, SCOTLAND.
IMPORTATION OF PLANTS (SCOTLAND) ORDER, 1955

607. This Order consolidates, with amendments, the Importation of Plants Order, 1947-1954, the General Licence Orders made thereunder and the Importation of Raw Cherries Order, 1954. It prohibits or restricts the importation into Scotland (except under Licence) of specified plants, potatoes, seeds, vegetables and fruit and prescribes the forms of Health Certificate to accompany imports. A statutory Instrument with the above title has been enacted by the Secretary of State for Scotland and came into operation on the 1st April, 1955. (Legal Notification 308 of the 6th June, 1955, refers).

5.—RUBBER INDUSTRY (REPLANTING) FUND AMENDMENT
ORDINANCE, 1955

608. This is to provide means for implementing the Government proposals for assisting replanting in the rubber industry. (Federation of Malaya Ordinance No. 33/55 refers).

6.—DISINFECTANTS FOR USE IN THE TREATMENT OF MOULDY
ROT ON RUBBER PLANTATIONS

609. Agrisol Vulcan Red—this preparation has been added to the list of fungicides. (Federal Gazette Notification No. 515/24-2-55, refers).

R. G. HEATH,
*Director of Agriculture,
Federation of Malaya*

APPENDIX I

COMPARATIVE ACREAGES OF AGRICULTURAL CROPS

	1950 Acres	1951 Acres	1952 Acres	1953 Acres	1954 Acres	1955 Acres
Rubber	3,358,251	3,535,221	3,612,820	3,727,540	3,500,000	3,500,000
Oil Palm	95,982	97,377	100,182	108,265	109,000	111,000
Coconut	509,289	509,306	512,967	512,744	494,000	495,000
Padi (Rice)	930,530	875,390	831,050	834,010	845,990	891,090
Total	4,894,052	5,017,294	5,057,019	5,182,559	4,948,990	4,997,090
FOODCROPS:						
Tapioca	35,461	27,411	23,428	28,183	30,947	31,244
Sweet Potato	17,091	10,843	13,449	16,735	19,274	19,394
Sago	6,224	6,467	6,364	6,826	6,954	7,080
Sugar Cane	1,989	2,055	1,861	2,008	2,050	2,022
Groundnut	1,755	1,943	2,479	2,485	2,785	3,311
Maize	2,583	2,997	7,332	4,224	8,849	6,744
Yam	1,107	1,077	1,101	1,099	1,436	1,704
Colocasia	2,892	3,072	3,390	3,404	3,278	3,439
Ragi	*	39	25	111	158	101
Soya Bean	*	106	117	152	223	194
Pulses	*	784	1,569	1,945	1,556	1,415
Vegetable (Market Gardens)	10,844	10,671	12,640	14,910	18,106	20,204
Total Foodcrops	79,946†	67,465	73,755	82,082	95,616	96,852
FRUITS:						
Pineapple	23,981	24,468	24,843	23,930	27,949	34,848
Banana	48,150	39,988	40,257	48,508	56,384	56,831
Cashew Nut	2,207	2,102	2,120	2,105	2,134	2,083
Specified Fruits	66,547	*	*	*	*	*
Mixed Fruits	34,940	*	*	*	*	*
Durian	*	25,270	26,652	27,394	28,301	31,040
Rambutan	*	14,779	15,848	17,951	17,850	18,802
Mangosteen	*	7,342	8,025	8,561	8,588	8,408
Citrus Fruits	*	2,064	2,312	2,854	3,387	5,081
Other Mixed Fruits	*	41,823	41,889	42,314	42,256	38,881
Other Fruits under Sole Crop	*	2,925	2,210	—	88	42
Total Fruits	175,825	160,761	164,156	173,617	186,937	196,016
SPICES:						
Arecanut	48,391	47,659	44,862	46,300	45,417	40,303
Chillies	2,291	2,212	3,258	3,768	4,159	4,478
Pepper	148	156	204	377	678	676
Cardamom	2	1	—	1	—	—
Ginger	1,238	976	1,013	974	1,263	1,344
Sireh	2,768	2,729	2,900	2,983	3,100	2,967
Nutmeg	77	80	59	55	54	82
Cloves	283	226	195	183	176	175
Turmeric	889	838	731	959	1,097	1,088
Total Spices	56,087	54,877	53,222	55,600	55,944	51,113
MISCELLANEOUS:						
Tea	8,434	8,497	8,561	8,719	9,000	9,000
Coffee	8,951	7,435	9,299	9,286	10,557	12,603
Cacao	*	531	295	302	418	655
Tobacco	408†	2,109	3,830	2,579	4,489	4,200
Derris	571	428	244	426	463	512
Nipah	33,559	33,472	33,749	34,105	34,425	34,878
Gambier	986	831	932	908	910	775
Kapok	1,720	1,567	1,411	1,675	1,579	1,575
Ipecacuanha	219	179	250	143	143	140
Patchouli	37	16	8	37	81	83
Citronella	12	19	27	29	30	21
Gutta Percha	3,471	5,635	5,635	5,635	5,471	4,642
Other Miscellaneous	657	1,213	1,437	1,448	1,494	1,376
Total Miscellaneous	59,025	61,932	65,678	65,292	69,060	70,460
TOTAL ALL CROPS	5,264,935	5,362,329	5,413,830	5,559,150	5,356,547	5,411,531

* Not available.

† Incomplete.

GOVERNMENT PRESS, KUALA LUMPUR

